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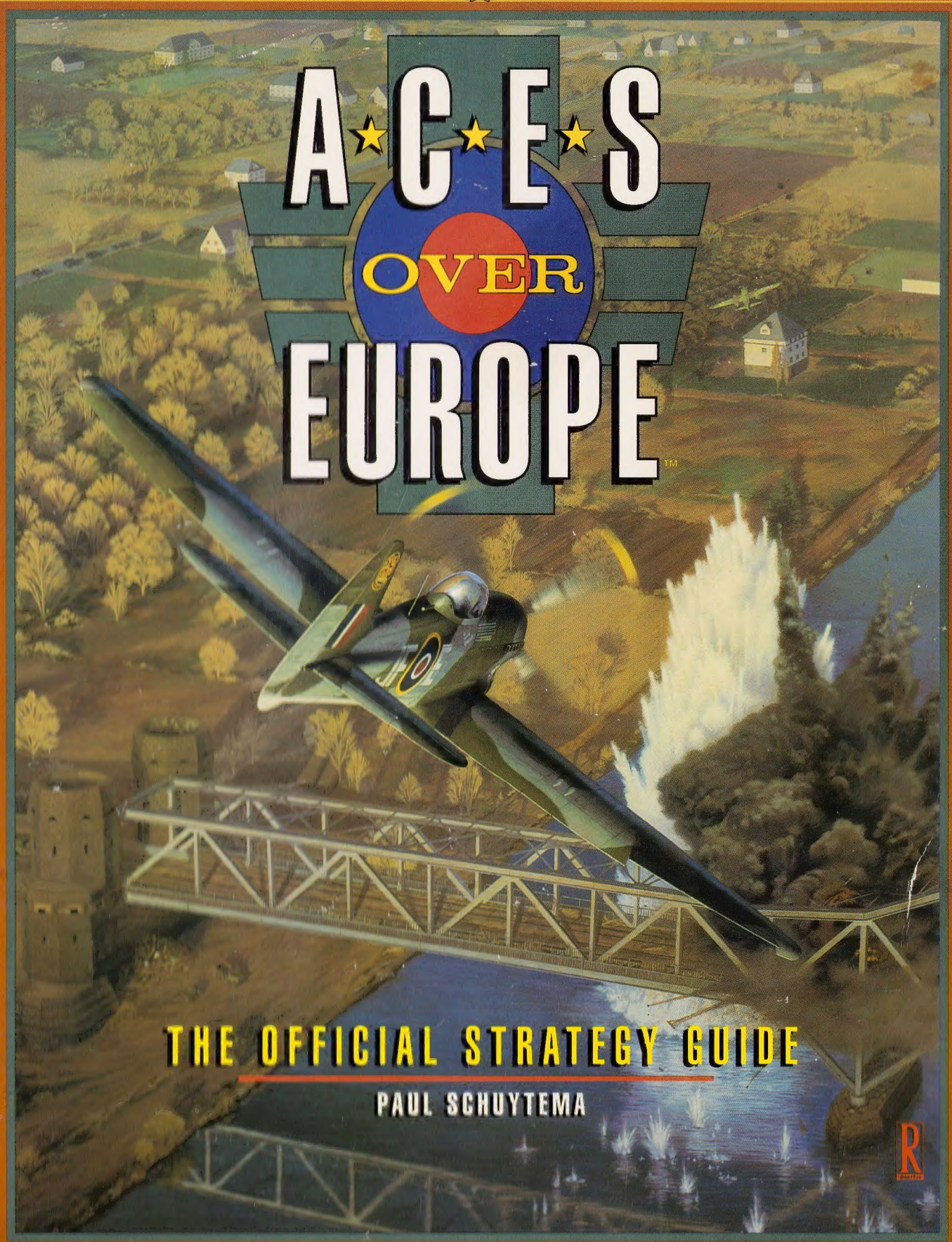

THE OFFICIAL STRATEGY GUIDE

PAUL SCHUYTEMA

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THE OFFICIAL STRATEGY GUIDE

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ACES OVER EUROPE

THE OFFICIAL STRATEGY GUIDE

Paul Schuytema

Prima Publishing
P.O. Box 1260BK
Rocklin, CA 95677-1260

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Executive Editor: Roger Stewart
Managing Editor: Neweleen A. Trebnik
Project Editor: Dan J. Foster
Copy Editor, Indexer: Mary Jane Mahoney
Book Design and Layout: Danielle Foster, Scribe Tribe
Cover Design Adaptation: The Dunlavey Studio

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Library of Congress Catalog Card Number: 93-87194

ISBN: 1-55958-520-X

Printed in the United States of America

94 95 96 97 CWO 10 9 8 7 6 5 4 3 2 1

To Mary, who is the spark

Contents

Foreword xi
Acknowledgments xv
Introduction: Seeing the Air War with Pilot's Eyes xvii

A Brief History of Air Power 1

Warfare Evolves 2
The Great War 7
The Emerging Role of Air Power 11
World War II Begins 13

Dogfighting: An Initiation 15

Taking to the Air 17
Taking on an Ace 25
Technological Similarities 27
A Pilot's War 31

The Role of the Luftwaffe 33

Germany Rebuilds Its Air Power 33
The Luftwaffe Readies for War 37
Flying for the Luftwaffe 44

Preparing to Fight—Flight School 51

Flight Training 52
Flight Dynamics 101—The Forces of Flight 58
The Basics of Flight 61
Basic Flight Maneuvers in Aces Over Europe 64
Luftwaffe Pilots 77
Duty Orders 78

The Battle of Britain and Beyond 79

The Battle 79
The War Grinds On 86
Fighter Forces 89
Big Week 91
An Allied Deep-Penetration Bombing Mission 93
On-The-Fly Logistics 98
The Luftwaffe Counters Allied Attacks 103
Strategic Bombing Campaign 108

The Weapons of Air Superiority 109

Building the Planes of War 110
The Form of a Fighter 113
The Engines 115
The Guns 119
Other Offensive Capabilities 123
The Cockpit—A Home for the Pilot 125
Defensive Factors 132
The Fighters of Aces Over Europe 134
The Bombers of Aces Over Europe 162

Preparing for Overlord 173

The COSSAC Invasion Plan 173
Interdiction Missions 175
Close Support Missions 178
Germany Struggles on the Eastern Front 181
The V-1 Rocket and Crossbow Missions 181
The Luftwaffe Readies for the Invasion 185
Historic Missions 187
Beyond D-Day 197

Secrets of Battle: The Art of Combat Flying 199

Aerial Maneuvers 200
The Art of Detection 209
Closing in for the Kill 210
Aerial Gunnery Skills 211
Evasive Tactics 215
Dogfighting: Attacks against Fighters 217
Attacks against Bombers 218
Group Tactics 221
Taking on an Ace—Reprise 227
Emergency Procedures 229

An Airman's Life 233

Life as a Fighter Pilot 233
Enlisting in a Career 243
Career Campaigns 254
Things to Consider 261
Retirement 263

The Never-Ending Assault 265

Luftwaffe after D-Day 266
Battle for France 268
Failure of Market–Garden 270
Deployment of the Me-262 Jet Fighter 272
Resurgence of the Luftwaffe 276
Battle of the Bulge—Christmas 1944 278
Operation Bodenplatte 282
Adolf Galland and Jagdverband 44 288
Into Germany 290
Conclusion 293

Getting the Most out of Aces Over Europe 297

Menus 297
Mission Setups 298
Mission Briefing 300
Adjusting the Simulation to Fit Your Machine 306
View Controls 309
Making Your Flying Experience More Enjoyable 312
A Final Word 318

Appendix A: Mission Recorder 319
Appendix B: Pilots, Planes, and Targets 329
Appendix C: The SQUAD0.DAT File 343
Appendix D: Control Options 355

Bibliography 363
Index 367

Foreword

Recently, I had the opportunity to visit a local high school and lecture about the value of higher education. When the day was finished, I walked away from the classroom with a heavy heart. In each class I had asked the students about several legendary figures from World War II aviation lore. Few students recognized the names, and fewer still really understood what air warfare was all about. I suppose in a way this is not surprising. Hey, it's the 90s after all, and World War II seems so long ago that it is out of reach for many in our society today. There just is no way for the postwar generations to relate to the dwindling number of veterans who crewed the B-17s and 24s, P-51s, and Me-109s. To those in the postwar generations, World War II is a distant series of historical events. Since most images of the war were taken with black-and-white film, that has affected our perceptions as well—it makes the war all the more distant and difficult to relate to.

Until recently, for those who wanted to learn, wanted to relate to the exploits of their fathers and grandfathers, there were precious few ways to bridge this perception problem. Interviewing air crews gives a greater understanding, but the interviewer rarely gets the feel of "what it was really like" to be in the cockpit of a P-51 during a dogfight over Germany. Seeing mock dogfights

at airshows only brings a greater appreciation for the hardware. There was nothing to give the interested person a feel of what the pilots experienced.

With this in mind, the *Aces* team at Dynamix set to work on the Great Warplanes series. *A-10* was our first project, followed by *Red Baron* and *Aces of the Pacific*. Our latest release, *Aces Over Europe*, is our way of bridging the perception gap and giving our customers a taste of what the air war over Europe in 1944 to 1945 was really like. With *AOE*, we tried to convey the drama, the fear, and the excitement of air combat in a manner that would give our customers not just a fun gaming experience but also a greater appreciation for what the veterans of World War II endured in the skies over Germany.

Our team worked hard on this goal. Damon Slye and Chris Shen designed the sim with an eye to capturing a "Time–Life" look and feel to the product. This meant making the historical era accessible to everyone, not just those who lived through it. Lincoln Hutton and Ryan Hinke, two of the most talented programmers in the industry, created the sim itself, including the flight models. Paul Bowman designed and programmed the AI for the enemy aircraft. Chris Hunt wrote the historic mission scripts, working closely with Lincoln and myself in the process. Chris Reese and Darek Lukaszuk built the shell and added such features as Garaud Shading in the vehicle preview. Our artists, Mark Peasley, Tito Pagan, and Jarrett Jester, took photographs of aircraft models and then superimposed them into rendered combat scenes for the shell artwork. Peter Lewis, Damon Mitchell, and Vance Naegle built the cockpits for each aircraft as well as all the vehicle and target shapes in the sim. Tucker Hatfield, Chris Hunt, Duri Price, Dan Hinds, and Corey Reese worked long, hard nights testing *AOE* to ensure we met our rigid quality standards. In short, the *Aces* team strove to give its customers as much of the texture, the look, and the feel of 1944 to 1945 as it possibly could with Aces Over Europe.

My job was to ensure that *AOE* was as historically accurate as our platforms would allow. I spent my time pouring through 1944-vintage combat reports, examining diaries, and interviewing combat pilots who flew in the skies over Europe during the last stages of the war. The information I gleaned from these sources was passed on to the programmers, artists, and designers. They then integrated the historical information into *Aces Over Europe*.

Boot up our sim and experience the surprise and tension of getting bounced by a flight of Focke-Wulfs diving from out of the sun. Find out how much courage it took to make a second strafing pass at a convoy of enemy tanks, knowing full well that there are dozens of AA guns protecting the vehicles. Learn how tough it was for German pilots to attack B-17 formations or how difficult it was for them to even get to the B-17s since they first had to penetrate swarms of P-51s and 47s. And as you, the player of *Aces Over Europe*, gain in knowledge and experience with our product, so too we hope will your appreciation and admiration for those who really endured this, the last great campaign in the air that the world has ever seen. If we have been able to convey this sense of appreciation and respect to even a fraction of our users, then our goal has been realized. Enjoy *AOE* as a game, but learn from it as a sim. Above all, never forget the bravery and stoicism displayed by the air crews of all nations during that last year of World War II in Europe.

John Bruning, Jr.
Dynamix Historian, *AOE*

Acknowledgments

I know there is no way for me to thank all of those who have helped me along in this project, but I will give it my best shot. Thanks to:

Mary and Emmery for keeping me grounded as I slipped back into that time 50 years ago;

Roger Stewart, who gave me the nod and kept my droptanks filled with encouragement;

Dan Foster, my project editor, who deserves a special thanks for doing nearly everything right, prodding me when I needed prodding, and supporting me when I most needed support;

The copy editors and art staff at Prima Publishing for sculpting my work even further, especially Danielle Foster for excellent layout work.

Bill Marciniak, who helped me get the ball rolling down the right slope;

Tucker Hatfield at Dynamix for his help and insights into the game as well as his excellent technical editing;

John Bruning, Dynamix's historical researcher, for working through my facts with a fine-tooth comb and for providing such a wonderful forward—and, of course, for bringing to life a bit of the past;

Damon Slye for making the dual commitment to realism and playability—you created a real gem;

Dave Rice, who helped me connect to all those with whom I needed a connection;

David Fleming, Tom McManus, Fred Zurmuhlen, and Samuel Hynes, all of whom took to the air back then and allowed me a glimpse into their worlds;

James "Jaybird" Johnson, a special thanks for his insights into target scoring and for his extensive spelunking into the world of *Aces Over Europe* data structures;

Jeff Rankin and Monmouth College for giving me the time and the resources to make this the best book possible;

Peter Riis, who shared with me his time, enthusiasm, research skills, and love of the blues;

The National Archives and Timothy Cronen at the Smithsonian Air and Space Museum—your knowledge of airplanes still astounds me;

Lotus Development for their fine word processor, AmiPro; I would have gone simply mad without it.

As I worked through the chapters of this book, I realized a sad but inevitable truth: try as I might, I simple could not cover it all. Volumes easily could have been filled for each and every chapter. I apologize in advance for any shortcomings, and I most certainly hope that this book helps to add to your *Aces Over Europe* experience and your understanding of the unique, dangerous, and exciting air war that occurred over Europe 50 years ago. All photographs appear courtesy of the National Archives with the exception of Photo 4-1 (Tom McManus) and Photo 6-11 (the author).

Maps and illustrations are by the author.

Introduction: Seeing the Air War with Pilot's Eyes

Dulce bellum inexpertis.
(War is delightful to those who have no experience of it.)

Erasmus

Fifty years ago the fates of empires, kings, ministers, shopkeepers, and children were being decided in the most savage of all man's contests: war. The Second World War spanned the globe, fueled by nationalism, pride, irrational despotism, and a belief in commonsensible humanity. The Good War, as some have tagged it, brought out the best and worst in twentieth-century mankind.

Millions died, millions more were wounded or captured, and nations fell. The world order, groaning like the tectonic shifts of the continents, reorganized itself for the second time in a generation.

The Lessons of History

Sadly, though, the lessons of the war are becoming more and more distant memories, evolving from the word-of-mouth stories passed from father to son to merely words on a page. A new generation has grown up since the Vietnam War, unaware of the horrors or the mandates of large-scale conflict. As our young grow to maturity, we are loosing our connections with the players in that great struggle called WWII. The veterans still have their stories to share, but the decades have dulled their memories.

Families have thinned, decentralized, and fragmented. The eager audience is diminishing for these excellent storytellers.

What, then, was the struggle really like? Are we left to merely read about history or to see the struggle as we watch films and documentaries? This is a dangerous practice, warns Samuel Hynes, a Navy war pilot, author and professor at Princeton University. Gleaning history from official sources always serves to dull the moment, to generalize where specifics are needed, to revise where the truth is uncomfortable. Once we step back past the primary sources of history, we lose the vitality and immediacy of the experience.

The Air War

The Second World War was the single largest showcase for the technology of warfare, from the rudimentary radar of the British to the V2 missiles of Hitler as the development of air power became a vital arm of military doctrine. In WWII, fighter aircraft and bombers alone did not win the war, but the struggle in the air was inseparable from the struggle on the ground.

If you read any general history book on the war you will have an idea how important the air war was to the Allied victory and how Germany's failure in the air was a cornerstone of their failure in the war. Read the accounts, and you will learn of battles, campaigns, and missions. You will read about formations of scores of B-17s flying over Berlin and of battles between Spitfires and Messerschmitts in the skies above the cliffs of Dover. Rarely, however, will you find accounts of the men who flew those planes, the fighter pilots who fought cold, exhaustion, and nausea—whose muscles tingled as they circled their planes once more to get a bead on an opponent.

Those stories are left out of the history books and can be found only in the personal stories of the pilots. Yet even listening to the accounts of a veteran cannot bring the experiences completely alive. Minute-by-minute details have been lost through the years. Tales of emotions live long, but the minute details and hard decisions fade into a wash of general impressions.

Aces Over Europe

Boot up *Aces Over Europe*, enter a mission, and suddenly you are there—behind the stick of a Focke-Wulf 190, hopelessly

outnumbered, low on fuel, watching the bombers destroy your home city. Every moment you relive the decisions made by the pilots 50 years ago. Check your six to make sure a bandit isn't bearing down on your tail. Check your RPMs. Is the engine overheating yet? Break left to avoid the turret fire coming from the B-17 as you dip down and pull up to fire between its wings.

Each mission will take you into the past, allowing you to relive the first-person experience of a conflict which occurred decades ago. In the cockpit of a 2000-horsepower fighter aircraft, the generalities fall away—you become a specialist. The large-scale ebb and flow of the war diminishes, and you must contend with hundreds of constantly changing variables, keeping focused on the task at hand and your own survival.

Spend a few moments in the cockpit of a Focke-Wulf or a Mustang or a Spitfire and gain an appreciation for the tests a fighter pilot had to endure on each and every mission. You will come away from the experience learning from the details, not from an historian's overview of the struggle, thereby learning from your unique opportunity to relive, recreate, and resurrect a vibrant part of our human history.

The Scope of the Simulation

Aces Over Europe is an extremely complex, detailed, and layered simulation. Damon Slye, the visionary who created Dynamix's *Great War Planes* series, has gone to great lengths to recreate the true experience of being a fighter pilot in the European theater of WWII.

John Bruning, Dynamix's historian, who is completing his master's work on military aviation history, researched the air war from every conceivable angle. When recreating an historical mission he needed to know the specifics—what kind of planes were flying? What time of day was it? What was the weather like?

The programmers at Dynamix worked hundreds upon hundreds of hours to make sure that the number crunching of the simulation recreated the feel, variety, and nuances of the many planes you can fly. Dive a P-38 too steeply and the ailerons will lock from compressibility. Try to enter a dogfight without releasing your bombs or drop tank, and your performance will suffer. Take a turn too tightly, and the *G*-forces will cause you to black out.

The Aim of This Book

A simulation as complex as *Aces Over Europe* requires several guideposts to make the experience of playing the game more rewarding. Playing *Aces Over Europe* is not just a one-weekend affair. Learning the game, acquiring the skills needed to perform, and enlisting in a career all take hours and hours of play. The simulation is long lived, one which rewards the interested player with months upon months of satisfying gameplay. *Aces Over Europe* is a game that never grows old; it gets better as a player's skill develops.

By enabling the player to adjust a myriad of difficulty levels, the game can be tailored to any skill level; maximum difficulty provides a challenge which takes months of practice to master.

Dynamix's excellent manual provides the basic information you need to play the game, including an overview of the historical context, basic data on the planes you will encounter, and an essential reference guide to the controls and menus you will utilize in the game.

It is the aim of this book, then, to go one step further. In the pages that follow, you will explore the history of the air war in more detail. You'll learn not only about the movers and shakers such as Goering and Churchill, but also about the daily life of the pilots who flew the missions.

Working through this book, you will be immersed in the background that will place your missions within the context of the war. You will acquire the necessary skills and strategies, practicing exercises the cadets of 50 years ago practiced. You will practice combat maneuvers and procedures, gunnery skills, and emergency tactics. You'll study your opponent's planes, learning the strengths and weaknesses of each adversary you must face.

It is my hope that this book will heighten your enjoyment of *Aces Over Europe*, making you a better and more knowledgeable computer pilot. Hopefully by reading, practicing, and flying, you will come to know firsthand a portion of our history.

We Can't Do It All

As excellent a simulation as *Aces Over Europe* is, it still can't physically transport you back in time. Although it is my hope that this book is interesting and informative, by its very format it is limited and narrow in scope.

My desire, then, is that becoming adept at *Aces Over Europe* can serve as a cornerstone to your seeking more detailed accounts of the war. I hope you will track down air combat veterans and take them out to lunch and listen to their fascinating, personal stories.

Still, though, this will only scratch the surface. No simulation, book, or story can recreate the visceral fear the pilots must have felt on their first combat mission, nor can it convey the burning, irrational anger in a pilot's belly as he watched an enemy destroy his closest friend—or perhaps the warm feel of chivalry in the clouds 20,000 feet above the war, when an opponent becomes a companion, holding back on a fatal shot and wagging the wings of his Messerschmitt as if to say it was a good day's competition—I hope we can meet again.

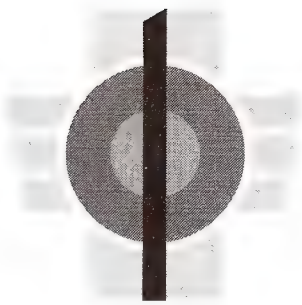
No history can recreate the deafening sound inside the cockpit of a P-51, the taste of the base's rations, the smell of oil and fuel on the tarmac, or the sweet perfume of dancing cheek to cheek with a local girl on a night's liberty.

Finally, all the histories in the world cannot recreate each pilot's unique view of the war. Was it a challenge? Perhaps the pilot firmly believed that the enemy must be killed, or perhaps the idea of killing another human was revolting and done each day under the greatest duress. Possibly the distance and solitary nature of flying a plane made it all too abstract for a young nineteen-year-old, and the war became more of a game than anything else.

To the Air, Then!

Even a simulation as detailed as *Aces Over Europe* cannot recreate it all, but it can come as close as possible. I hope that you will boot up your game with enthusiam, turn the page, and step back in time behind the stick of a lean, powerful fighter aircraft, eager to participate in the challenges ahead.

To the skies then, and remember—check your six. It's a war out there!



A Brief History of Air Power

Cannon and fire-arms are cruel and damnable machines; I believe them to have been the direct suggestion of the Devil.

Martin Luther

Throughout the centuries, humankind's tribes have searched for the forceful edge over their opponents, whether to conquer territory or to vanquish a mortal enemy. From the primal use of bones and sticks to the development of antimissile missiles, their methods of aggressive persuasion have evolved greatly.

Since the first humans marveled at the ability of birds to take to the air in escape, there has been an urge to join them in their windy ether. As Icarus discovered when his feathers and wax fell away from his arms as he plummeted toward the sun, humans had a long way to go before the air could be their domain.

Sentenced to roam the hilly knolls, we fought battles in which opposing forces collided toe-to-toe for the right to claim a patch of land. Occasionally, when the surrounding terrain would permit, a quick and young scout could climb to a rocky crag to oversee the approaching phalanx, then run the information back to a commander who could work out the best defense.

Yet this reconnaissance, while evolving into a crucial arm of human warfare, was still just a best guess. There were too many variables—too many places to hide in the trees and caves and riverbeds of a rolling vista to give an accurate picture of the ensuing battle.

Warfare Evolves

In the organized battles of the eighteenth and nineteenth centuries, a new tool had entered the mainstream of conflict science. The long-range, black-powder gun was finally a viable weapon. Though it counted its range in tens of yards and its accuracy was in "broadside-of-the-barn" terms, it far outdistanced the saber and pike, and the lead musket ball packed a force that a longbow just could not match. The era of armored knights, pikemen, and conquistadors was over. Now, sharply dressed foot soldiers marched by the hundreds to the staccato cadence of the color guard's drums, meeting their opponents across a hundred yards of pasture. With flintlocks held low and bayonets freshly sharpened, the forces walked together firing, falling, reloading, and striding ever forward, able to see only the nearest wall of opponents through the blue–black cloud of gunpowder smoke and never able to accurately guess what lay behind them.

Enter the Balloon

Picture, if you will, these great battles set among the pastures and fields of Europe. Now imagine that your vantage point is 300 feet above land; you are able to see the forces and formations of both sides, able to judge the tactics and logistics from a bird's-eye view.

It happened on June 26, 1794. The French, facing off against the Austrians in the Battle of Fleurus, made use of a tethered balloon to observe the ebb and flow of the battle and to direct,

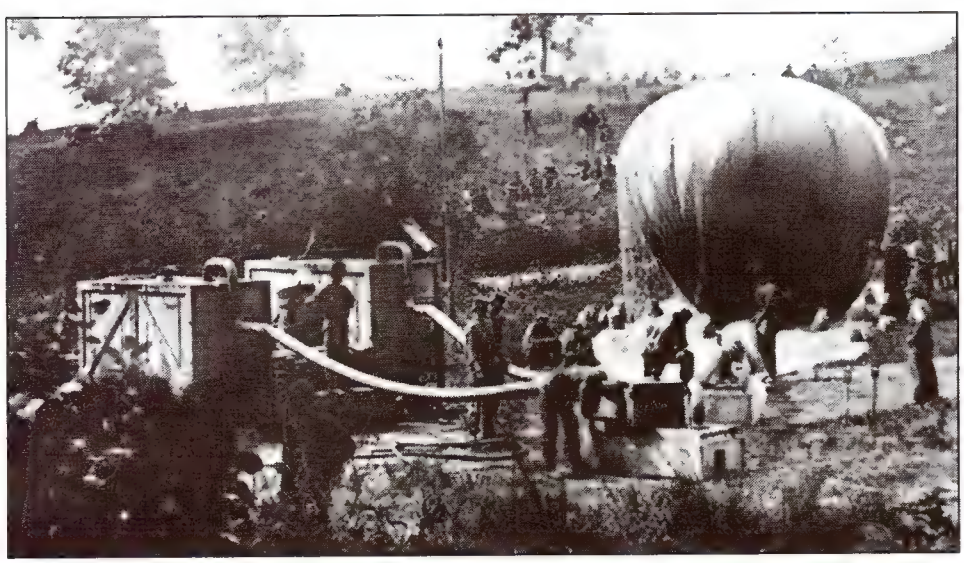


Photo 1-1

A balloon is filled with hot air generated by an enclosed wood fire, 1862.

through the use of simple signals, the aiming of the French artillery batteries. The new dimension of height was added to warfare. Still, though, the balloon had acted only as a means to observe and control a two-dimensional conflict.

It was not until over 50 years later that the military advantage of an air presence was felt. In 1849 the Austrians besieged the historic city of Venice and utilized over 200 tethered and unmanned balloons to drop bombs on the city. Due to strong winds and the tendency of the balloons to jerk and tug against the rope tethers, the accuracy of the bombing was unpredictable and the effect of the first aerial bomb assault proved to be negligible.

Photo 1-2

Professor Thaddeus Lowe observes the Battle of Seven Pines in the American Civil War, 1862.

Several times in the decades that followed, balloons were utilized as bomb platforms; but they were controlled, first and foremost, by the chaotic and unpredictable variances in the wind and weather, leading to nothing more than a random and ineffective sprinkling of bombs. It seemed, for the time being, that the clouds were not meant for humankind and that armed conflict would remain an exercise in two-dimensional tactics relegated to the land.

The Birth of the Airplane

In the late 1890s, several groups initiated research to create not a balloon, but a heavier-than-air craft—an airplane. Although the experiments had produced no concrete results and no sustained, powered flight, word of the development reached a pair of North Carolina brothers who designed and manufactured bicycles. Fascinated by the promise of a controllable craft able to lift a man into the air, the Wright brothers began their own series of experiments on the wide, sandy beaches of Kitty Hawk. (The site was selected on the advice of the U.S. Weather Bureau.) Before attempting any powered flight, the Wrights first concentrated on creating a controllable airframe and set out to work on multitethered kites. After completing nearly 700 flights in a series of evolutionary gliders, the Wrights began the quest to turn their kite into an airplane.

Their primary design concern was to find a powerplant powerful enough to provide the thrust to keep the plane airborne, yet light enough to allow takeoff. After shopping their plans around to automobile manufacturers, they received nothing but skeptical smiles and polite dismissals. So they set out to create their own engine—a small, 12- to 16-horsepower engine that would drive, via a belt system, two wing-mounted, rear-facing propellers.

On a cool, breezy December 17, 1903, Orville Wright made the first powered, sustained flight in a heavier-than-air vehicle. The airplane was born. Utilizing a guillotine-like counterweight system to propel the craft forward, the canvas-and-wood plane took to the air, flying no higher than 30 feet as Orville lay across the biplane's mid-wing, controlling its journey over the grass-strewn Carolina beech.

The Wright flyer was basically a powered kite, able to fly only with the constant control adjustments of the pilot. The frame,

like a kite, was statically unstable, meaning that some form of resistance or control operation was required to keep it flying. Unlike a traditional glider, the Wright flyer could not glide on its own. Without the pilot's constant adjustments, the plane would crash instantly.

The flyer was a boxy contraption. In front of the twin wings were two smaller sets of wings, or canards, which served as the vertical flight controls, acting in the same fashion as the elevators on later planes. The horizontal control for turning and banking was achieved by using cables to warp the large wing surfaces. By twisting the entire wing, the characteristic of the wing's lift would change, pushing the plane either left or right.

Military Possibilities

On December 23, 1907, Brigadier General James Allen, the United States' Chief Signal Officer, issued specifications for the first military aircraft. On February 10, 1908, the Wright brothers signed a contract with the United States Signal Corps to design a plane capable of carrying a man 125 miles. By 1909,

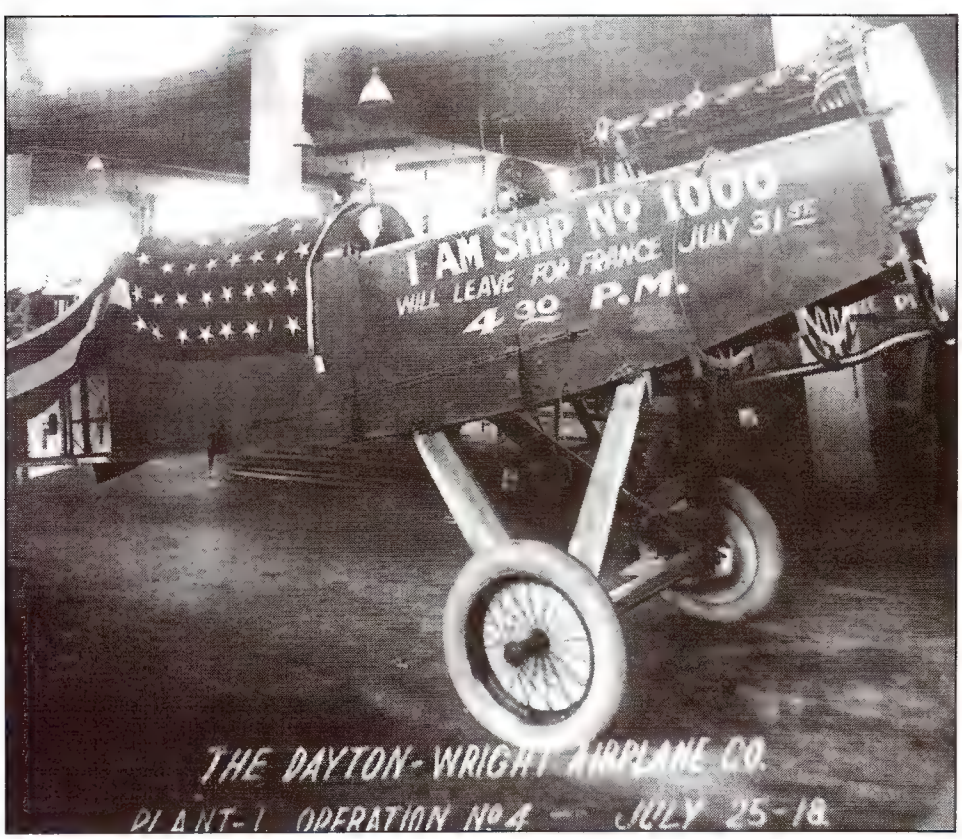


Photo 1-3

The Dayton–Wright Airplane Company, July 25, 1918

the design had been successfully completed. In that same year, the brothers formed the American Wright Company, one of the world's first aircraft manufacturing companies.

However, it was Italy that first utilized an airplane as a purely military tool. In the Italo–Turkish war in North Africa, the Italians flew an airplane on reconnaissance missions over the Turkish lines. The tactical implications of this new vantage point were not lost on the Italian commanders; soon the Italians were using planes to drop bombs and propaganda leaflets on the Turkish positions and to shoot aerial photographs of the conflict.

In the years that followed, the military role of the airplane moved quickly from one of purely reconnaissance to one of bomb deployment. Airplanes could deliver ordnance with greater accuracy than long-range artillery, and their vantage point enabled the pilot to make tactical decisions based on what was seen out of the cockpit. In the early days of aerial bombing, ground guns

Photo 1-4

Mexican Punitive Expedition, Army Airplane #75, Camp El Valle, Mexico, 1916

were not yet accurate enough to be used as a defense against the airborne attacks, so other aircraft were deployed, armed not with bombs but with guns, and charged with intercepting and eliminating the bombers.

The Great War

World War I saw the greatest leap in the technology and use of the airplane. At the onset of the European conflict there were hundreds of planes on the Continent, but all were regarded as reconnaissance aircraft and not as military weapons.

While the generals of the war were grappling with the strategic evolution and de-evolution of the ground war and dealing with the introduction of the machine gun, poison gas, effective long-range artillery, and troops of unparalled numbers, the airplane was quietly undergoing a design revolution.

During the first months of trench warfare, twin-seat biplanes were used as reconnaissance planes in which the rear "passenger" was charged with battlefield observation, hastily scribbling notes in the vibrating cockpit and taking occasional photographs. As the population of reconnaissance aircraft grew, so did the aggressiveness of pilots. Observers carrying pistols attempted to shoot the pilots of rival airplanes. Bricks were dropped out of the aircraft, and chains were dangled in an attempt to snare an enemy's propeller.

Photo 1-5

Canadian troops charging from their trench, France, 1917

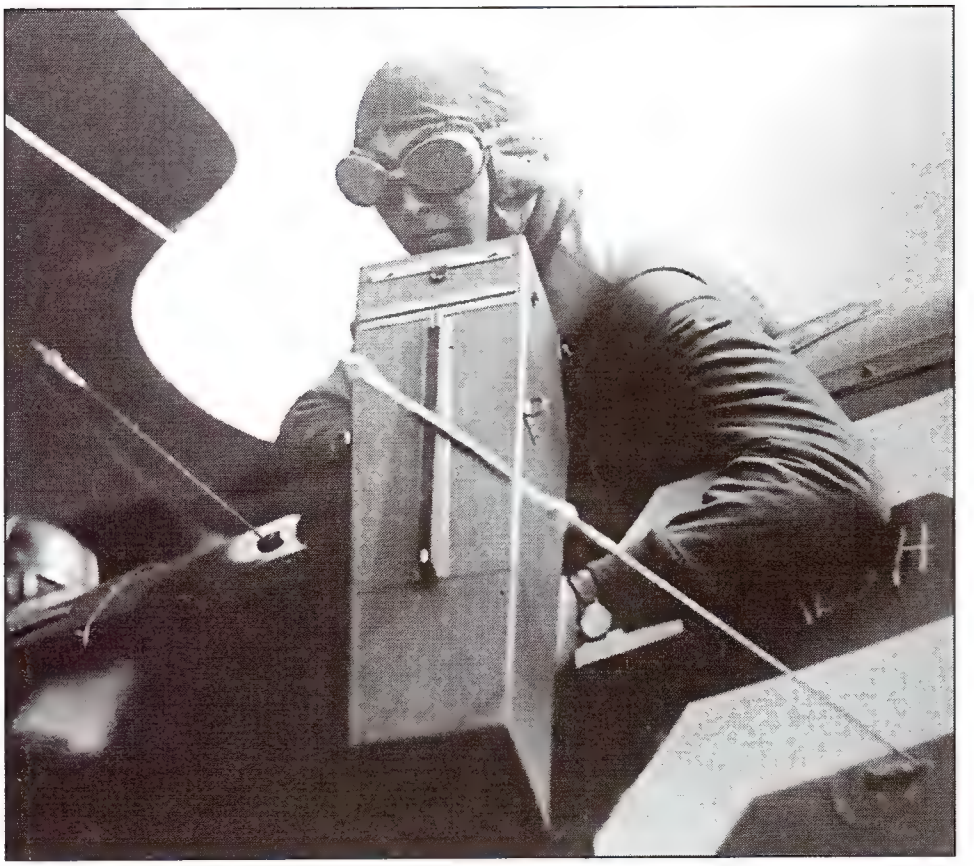


Photo 1-6

Observer shooting troop formations with a Graflex camera, 1917

Guns Take to the Air

These early air warfare attempts were largely futile until a gun mount was employed. The observer could now operate a bridled machine gun in an attempt to down enemy aircraft. While the machine gun proved a formidable force on the ground, in the air it was still in its tactical infancy. The vibration of the airframe, coupled with the vibration of shooting a mounted gun on an unfixed platform (the airplane), made aiming more a matter of luck than skill. Also, the machine gun was still in the earliest stages of its evolution, and catastrophic jams were all too common. Some gunners became adept at field stripping and rebuilding their guns in flight, creating all manner of ingenious tools to poke and jab into the gun to free the jam. Despite all the obstacles, though, quite a number of kills were recorded.

Roland Garros, a French pilot in the early days of World War I, tried something new: he mounted a gun on the nose of the plane, sighting down the fuselage and right through the propeller disc. To guard against shooting up his own propeller, he had the wooden prop modified with several metal plates, grooved to

Photo 1-7

German aviator preparing to drop a bomb on the Western Front, 1916

deflect errant bullets away from the prop and, more importantly, away from the pilot.

Despite the fact that loading the propeller with extra weight decreased the biplane's performance, the pilot-as-gunner approach worked. Utilizing the plane as a complete weapon, Garros was able to shoot down five German observation planes before engine failure forced a crash landing in enemy territory.

On the other side of the trenches, the Germans were working on their own plan to mount machine guns onto the cowls of their aircraft. Instead of protecting the propellers with armor, however, Dutch inventor Anthony Fokker developed a gearing system that simply would not let the gun fire when there was a chance of hitting the propeller.

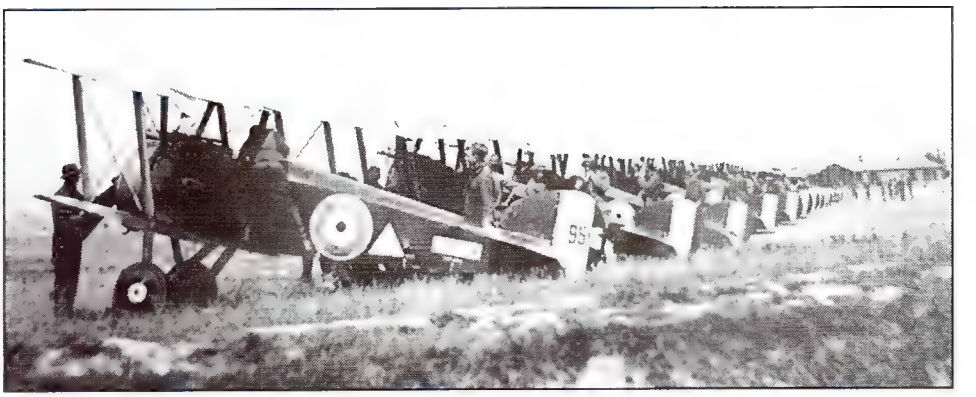


Photo 1-8

148th American Aero Squadron field—making preparations for a daylight raid on German trenches, August 6, 1918

Knights of the Air

Once the deployment of fixed, through-the-propeller guns was the standard fare, the technological race was on. While the ground troops battled a slow, morale-crushing war of trench attrition, the pilots who flew through the clouds were the new elite. Like the lords of the feudal age who fought for honor with their swords, the new knights of the air used their planes as both steed and lance, fighting looping, twisting battles over the trenches of Europe, shouting at each other as they circled with silk scarves flapping in the wind. The concept of an air ace developed quickly, and its respect earned an ace the admiration of his fellow pilots and the fear of the enemy.

Although in the grand scheme of things the air war over the trenches in WWI had little effect on the conflict as a whole, this was a period of discovery and technological growth as well as a source of exciting, romantic propaganda for the folks back home.

However, the planes these knights flew were by their nature slow and fragile creatures. The warped wood of the frame was covered with a skin of taught canvas. Control surfaces consisted of a combination of brass hinges, steel wire, and cotton duck. In the cockpit, the pilots sat on wicker seats, occasionally sliding a stove cover underneath them for protection from the unpleasantness of a through-the-seat bullet.

Noise surrounded the pilots. Wind roaring past their ears, the engine sitting in front, the gun blasting away—it must have seemed a horribly chaotic environment for such a solitary pursuit. Then, the best pilots came from the ranks of athletes, sports aviators, and the upper class. The demands of controlling the plane were a mental and physical struggle. To bank a Fokker

triplane into a tight turn, a pilot would have to muster all the strength possible to tug at the control stick.

The WWI tactical fighting doctrine was made axiomatic by one of the first true air aces, Oswald Boelke. In his "Boelke Dicta," a mantra of dogfighting rules that he taught to his pilots, he outlined the basic principles of air combat tactics that are still viable today.

Basically, he told his pilots to use their wits to craft a situational advantage in a dogfight. A pilot should use altitude as a tool to harness the potential energy of a dive; he should employ the element of surprise whenever possible, diving with the sun at his back to make him invisible; he should attack from behind; and, lastly, a pilot should turn into an opponent's head-on attack (making a more difficult and shorter duration opening for an opponent than turning away, which allowed the enemy aircraft to maneuver on the pilot's tail).

Observers watching a dogfight from the trenches saw planes square off in an organic helix of spirals, each attempting to turn inside the other to get a clean, leading shot into the other plane's engine compartment or cockpit.

While the air war had no decisive effect on the results of WWI, the foundation was laid for future air conflicts. Italian General Giulio Douhet mirrored the words of Stanley Baldwin's dictum, extrapolating the future of air warfare, saying, "The bomber will always get through." He and others speculated that a formation of bombers could be the invincible war machine, laying waste to an aggressor's infrastructure at will. On the two-dimensional battlefield, defenses could be strong, but a city could not protect itself from the air and was eminently vulnerable to bombing attacks.

The Emerging Role of Air Power

In 1920, even though the concept of a bomber aircraft had seen real-world trials, there were still skeptics who felt that bombs delivered from an airplane could do no real harm. It was impossible, they argued, for a plane to approach and destroy a battleship. The plane would be shot out of the sky; and if it indeed managed to deliver its bombs, the damage would be negligible.

General Billy Mitchell, of the fledgling U.S. Air Corps, took it upon himself to prove this view wrong. In 1921 he sunk the

German battleship *Ostfiesland* with 2000 pounds of bombs delivered from his airplane. A ship once deemed unsinkable had fallen prey to the new airborne predator. Aerial bombing had shown its teeth.

Visions of Invincible Bombers

By 1934 it seemed as if this new view about the nature of air power was to be proved very true. Already, armed forces around the globe could imagine the bomber of the near future: a strong, all-metal monoplane capable of carrying several tons of munitions and reaching speeds of over 250 mph at altitudes above 20,000 feet. Dozens of bombers, flying in tight formations, could penetrate any flimsy air defense at will and lay waste to an enemy with an efficiency of destruction never before seen on the battlefield.

This was a logical mind-set, given that the fighter planes of the day had evolved little since the end of the Great War. Although it was generally agreed that a mono-wing was better than a bi-wing, the best-equipped fighter planes in Europe were feeble compared to the vision of bomber squads of the near future. Such planes as the Hawker Fury (a Royal Air Force biplane fighter) and the Polish PZL P-11 (an ungainly looking monoplane with a wing mounted on top of the engine's cowling) were the cutting edge in fighter technology. The planes were of fabric-over-wood construction, with underpowered engines that could barely take them over 200 mph, and equipped with small-caliber machine guns and fixed landing gear. The Hawker Fury took over 10 minutes to reach 20,000 feet from a scrambled takeoff, and in that time a bomber squadron could cover nearly 50 miles. With opposition like that, it was no wonder that the bomber concept of air superiority seemed axiomatic.

By 1936, the United States had a real plane that seemed to live up to the promise of the invincible bomber. The Glen L. Martin Company manufactured the B-10B, a bomber with multiple defensive guns to be utilized in formation flying. This airship was capable of carrying a payload of just over a ton of bombs in its belly. By the end of the year, 152 B-10Bs were in service in the United States, and nearly 200 had been sold overseas.

Rethinking the Bomber's Role

In the tension rising out of the Spanish Civil War, and as England began to explore the very possible reality of a bombing war with Hitler's Germany, several things became clear. First, if "the bombers will always get through" was to be the way the air war developed, then it would be an all-out war of attrition as each side pummeled the other with countless tons of bombs until one side broke. This was a grim scenario to consider.

As the Nazi threat loomed larger, Britain grappled with the possibility that it might not win a war of bombers. It would not have the time or resources for the research, design, and production of a massive bomber armada. There had to be another alternative.

Sir Thomas Inskip, Britain's minister for the coordination of defense, realized that the logistic principles of bomber design could be applied to fighters as well. Aircraft designers worked to replace canvas-over-wood construction with stressed steel. Testing showed that armaments could be gussied-up and larger engines could be installed in the planes. Also, the cost of producing a single fighter-aircraft was only a fraction of that to produce a bomber. In a very short time, Britain's focus shifted from bomber development to the development of bomber-destroyers.

The British began work on the Spitfire Mark I, but they were not alone in their race to develop a bomber-destroyer platform. The Americans developed the Curtiss P-36C Hawk, and the Germans put their Messerschmitt 109E-1 into the air.

World War II Begins

In late autumn 1939, the opening tactics of a pan-European chess game were put in place, and on September 1, Hitler's war machine, the Wehrmacht, blasted into Poland with a blitzkrieg of panzer divisions and screaming Stuka dive-bombers. In less than 2 weeks, Germany had all but defeated the brave but hopelessly outclassed Polish army. On September 3, both Great Britain and France declared war on Germany, and the opening moves of the war had begun. Just 21 short years after the Great War, World War II was underway.

Through the years of fighting, the role of air power changed and evolved, and so did the frantic pace of technological development. Creating the machines of war became a manic obsession for all sides. In WWI, tanks and planes were present, but they were not decisive of the outcome. War had consisted mainly of foot soldiers, guns, and artillery. Now, armies of foot soldiers made up only a portion of the entire equation. Tanks rumbled in divisions hundreds strong. Artillery guns were larger, more accurate, and counted their ranges in tens of kilometers. Warships and destroyers, submarines and fast attack boats, greatly improved from the warships of Jutland, scoured the waves. In the air, planes swarmed like insects, entire squadrons of bombers blacking out the clouds and shaking the earth with their low bass rumblings. Their ghostlike contrails left behind reminders of the fleeting passage through a realm Icarus only could have dreamed of.

Never before or since has there been such a large-scale battle for air supremacy. The pilots of WWII were the last of the breed of seat-of-the-pants pilots. Sophisticated navigation and targeting systems would come into their own by midwar, but even then it was still the pilots who made the final call. A pilot's skill, cunning, bravery, and keen eyesight were the tools that allowed him to control his 3-ton fighter and turn it into a weapon of war.

For 6 long years, the skies over Europe were the battlefield of a unique war, one fought in three dimensions instead of two, and one fought with powerful weapons of steel flown by pilots of flesh and blood. The air was the battlefield of the air corps of many nations—including the Luftwaffe, the Royal Air Force, and the United States Army Air Force—and the outcome of the conflict rested equally upon the flying machines and the shoulders of the men who flew them.

Dogfighting: An Initiation

The fewer men, the greater share of honour.

William Shakespeare

At its heart, *Aces Over Europe* is a dogfighting simulator, allowing time travel back to an era in which fear and excitement mingled in every breath. The simulation brings with it an opportunity to relive the decisions and challenges faced by the fighter pilots who squared off for their country's honor and survival above the fields and centuries-old villages of Europe. By recreating an accurate flight model of the planes of the Luftwaffe, the Army Air Force, and the Royal Air Force, *Aces Over Europe* provides an interactive window with which to re-experience history. The thrill—as well as the lonely, fearful anticipation the pilots must have felt as they flew hundreds of miles to do mortal battle in twisting, aerial melees—comes alive for you in the simulation.

All told, well over 100,000 planes saw combat service in the European theater in the years between 1939 and 1945. Over 200,000 pilots flew thousands upon thousands of combat missions. In the end, nearly 50,000 pilots lost their lives as the Third Reich's chapter in history came to a close.

More than mere statistics, however, these pilots lived and breathed in the cockpits of the planes they flew. Using every ability available to them, each attempted to best the enemy in battle. Some were successful, racking up hundreds of kills and earning reputations as the finest aces of their country. Others failed, either through bad judgment or bad luck—or perhaps the

Figure 2-1

A Dogfight in *Aces Over Europe.* An RAF Spitfire IX chases down a Bf-109.

Photo 2-1

A USAAF P-47 pilot, Lieutenant Joseph L. Eagan, poses on the wing of his fighter.

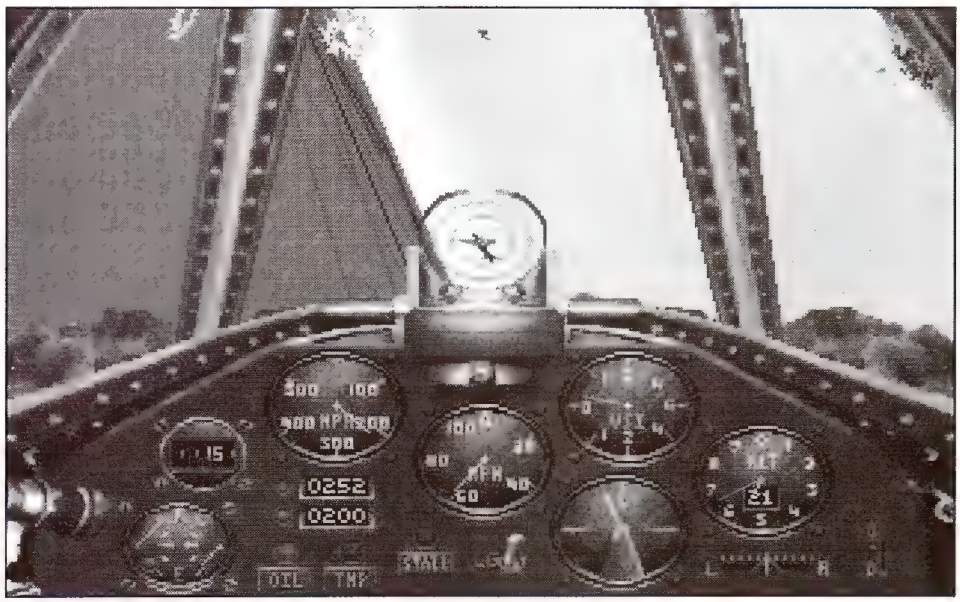


Figure 2-2

From the cockpit, a Spitfire positions for perfect aim.

swift and ominous hand of fate had sealed their demise even before the thick, black rubber of their planes' tires left the tarmac.

Taking to the Air

Throughout the pages that follow, the private journals of two young, fictional pilots will bring to life the day-by-day, mission-by-mission experiences of officers of the Army Air Force and the Luftwaffe. Their adventures and observations will serve as a bridge between the dynamic interaction of the simulation and the facts and figures of history.

All of the diary entries that refer to combat missions are taken from the Career missions available in Aces Over Europe. *All enemy encounters, dogfights, and observations can be experienced within the game itself (with the exception of the Luftwaffe entry concerning the Spanish Civil War).*

From the Journal of Lloyd "Buster" Stinson

2nd Lieutenant, USAAF, 336th Fighter Squadron, 354th Fighter Group; April 1, 1944

...clouds hung everywhere. Between the gray wash below and the reflections of the sun across my canopy, it was hard to make out anything. Two hundred feet below, looking like crosses of bleached bone, flew the six bombers we were escorting to some railway bridge in France. Miller said this will be the closest I'd ever get to France. No way to see the cancan girls from 19,000 feet.

Sleepy with the drone of the engine, I jerked awake as Miller's voice crackled to life on the radio. "Krauts at six o'clock, angels eighteen, turn and engage!" Instantly, my heart seemed to leap up my throat. I couldn't speak—could barely breathe. My first encounter, on April Fool's day no less. My hand felt wet and cold as I banked the Mustang left. When I jerked my head behind to check my tail, my breath fogged my goggles, the fog crystallizing to ice at the edges, framing my vision in jagged white.

Planes were everywhere. There must have been a half dozen of them to our four, and I saw shadows, silhouettes, and glints through the clouds as I turned. Both hands on the stick, I steadied myself, keeping my breathing regular as I throttled up to maximum and headed for a shadow that had just disappeared into a cloud.

The cloud swallowed me, and through the wet veil I could see the shadow ahead. I tapped the rudder left. The shadow was nearly in my sights, and I was gaining as we both climbed for altitude. I burst from the cloud, nearly ready to squeeze off a full-guns blast and... I froze. It was Miller's plane! The sun flashed off the red cowl as he banked and dove. I pulled both hands off the stick, holding them up as if to surrender. I could have shot him. I thought he was... I just couldn't tell...

Before going into any more historical depth, now would be a good time to get a feel for flying and fighting in *Aces Over Europe*. The simulation provides an excellent arsenal of training missions to hone a pilot's flying and combat skills, and these missions will be covered in greater detail in the chapters that follow. For now, we will explore the Aerial Gunnery training mission.

To maintain a consistent means with which to refer to the missions in Aces Over Europe *and the many options available through the game's layered menu system, the format below will be utilized, with each item separated by a colon representing a discrete menu choice. To recreate the mission, simply select the options as they are presented to you. (For a more complete overview of the game's menu trees, see Chapter 11.)*

FLY SINGLE MISSION: TRAINING MISSION: U.S. ARMY AIR FORCE: AERIAL GUNNERY

Mission Overview

This training mission puts you behind the stick of a P-51D Mustang, flying for the United States Army Air Force. It is a fly-and-shoot training mission, allowing you to practice flying (without the added difficulty of taking off or landing the airplane)

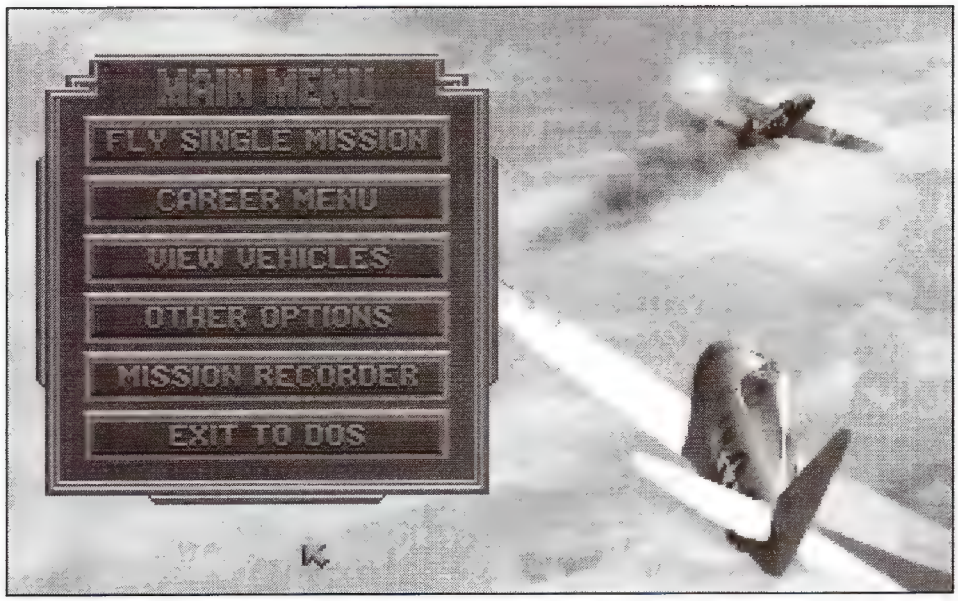


Figure 2-3

The main menu in *Aces Over Europe*

and shooting down a flock of Focke-Wulf 190s. The German planes are unarmed and fly in preset patterns until you are on their tail. Then they will exhibit limited flying intelligence.

As soon as you enter the simulation, tap Alt-R *on the keyboard to bring up the Realism panel. Even when just learning the game, it is a good idea to set the simulation's Realism settings to achieve a flying experience that is as true to life as possible. Click on all of the check box options (for a detailed explanation of the variables, turn to Chapter 11). All options will become checked except Limited Fuel, since this training mission assumes unlimited flying time.*

In the boxes below the main bank of controls, select the Standard Combat level and the Expert Flight model. That will bring the overall difficulty level of the simulation up to 90 (out of 100). It may seem like overkill, but learning to fly at the Expert level will give you more insight into the myriad of plane-specific performance and flight variables, and it means that you won't have to unlearn any bad habits later.

Click Accept to reenter the simulation.

Flying Your Mission

You begin the encounter with four planes at twelve o'clock, two at three o'clock, and two more at five o'clock. Throttle up to 75 percent and chase down the group of planes ahead of you. Fly

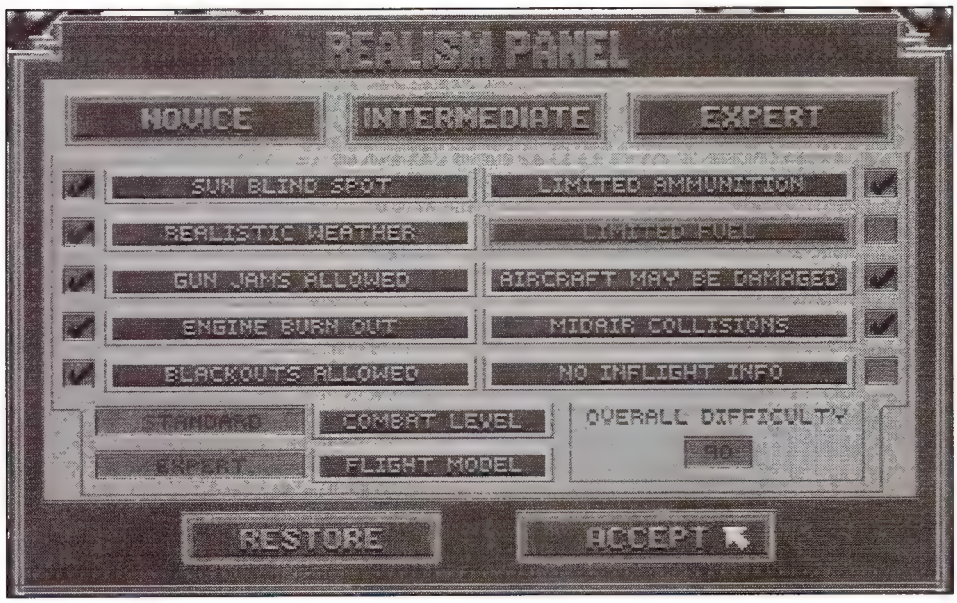


Figure 2-4

The Realism panel, where you may adjust the various levels of difficulty

steadily, and you may have to throttle up to maximum for a time to catch up (but keep an eye on your engine temperature gauge and throttle back when the warning light blinks on).

When you get in close, throttle back to 70 percent (about the same speed they're going) and switch to External view. Practice flying your plane among the Focke-Wulfs, with an easy touch on the stick as you bank left and right. Fire off several rounds and watch the tracers.

Figure 2-5

Your plane, and the drone Focke-Wulfs, as seen from the External view

Switch back to Internal view and check all of your views (left, right, behind, above, and front). Try to get behind one of the planes and pull in close, letting the tips of the 190's wings touch each edge of your sight. Keeping a steady hand, try to shoot down the plane, watching how the tracers fall and adjusting your aim accordingly. Stay behind (We'll learn about deflection shooting in Chapter 8), shooting through the oil smoke until the plane goes down. Congratulations! You've just scored your first confirmed kill.

When you want to end the training mission (or any mission, for that matter), tap the Esc *key.*

If you allowed the Focke-Wulfs to fade into the distance, they were noticeable only as small specks. It was only in the context of the training mission that you could be absolutely sure that they were indeed the enemy.

In the skies over Europe, the context was often not this clear. In a large majority of missions, fighters served as escorts to bombers. Before the large-scale deployment of long-range fighters (such as the P51-D Mustang) the fighters (such as P-47 Thunderbolts) would have to escort bombers for only part of their mission.

One of the most complicated logistical tests of the air war was creating the timing and navigation plans for a pinpoint bombing

Figure 2-6

Your first kill!

run (more about this in Chapter 5). Squadrons of fighters would have to rendezvous with bombers at a specific location, escort the flight for a prescribed number of minutes, and then break away, perhaps undertaking a secondary mission objective as they returned to base.

Robert Johnson

In March 1944 Lieutenant Robert S. Johnson, one of the European theater's highest ranking aces, commanded half of the 56th Fighter Group—a total of 35 P-47s—in an escort role taking B-17s on the first daylight bombing raid over the German capital of Berlin.

The bombing of Berlin was inevitable in the latter part of the war, and this subject was on the thoughts and lips of fighter and bomber pilots alike. What would it be like? How many fighters and flak batteries could the Germans muster? Was it suicide? In the words of one B-17 crewman, "Were we scared? Hell, yes, we were puckered."

At 10:32 A.M. on March 6, 1944, Johnson's group took to the air, switching to their P-47s' droptanks for the flight over the North Sea on their way to the coast of Holland. The squadron picked up the bomber escort (the "big friends") over the Zuider Zee River in Holland at an altitude of 25,000 feet. Many novice pilots flew in the squadron.

As they headed inland, flying above and behind the bomber stream, flak bursts dotted the sky, walking toward the bombers. Planes were seen approaching in the distance. After a few more seconds, they could be identified as fighters. The 56th prepared for a dogfight, and Johnson eased in his plane for a head-on run. The enemy planes approached, and the pilots of the 56th kept their fingers over the trigger buttons.

Just as their planes began to dart through the formation, an identification call went out over the radio—P-47s, not the enemy! In the bright glare of the sun and the pressure of the mission, it was nearly impossible to tell friend or foe from a distance. Although the pilots had to pass extensive tests identifying enemy and friendly aircraft silhouettes (see Chapter 4), in the heat of the moment with all of the contingent variables of the mission, identification was a hard task. The same is true in *Aces Over Europe*.

Keeping a watchful eye on your wingmen and the flight patterns of the planes in the distance is a sound strategy for avoiding gunning down friendly aircraft.

By 11:40 A.M., Lieutenant Quirk, commanding the 62nd Squadron, took his planes into a steep dive. Johnson watched, scanning for the enemy, but he could see nothing as the planes disappeared in the clouds below. Over the radio he heard the acknowledgment of an attack, but in the chaos Johnson couldn't get a fix on their position. His squadron held its course.

A few minutes later, another squadron of P-47s approached from the south. As they closed, it became clear that the planes weren't friendlies, but a mixed bag of Me-109s and FW-190s. The Germans headed straight for the bomber formation as Johnson's squadron turned to pursue.

Both friendlies and enemies flew through the .50-caliber machine-gun fire of the bombers, and Johnson noticed that two other groups of Germans were closing in for the kill, flying approximately 30 planes each. In the chaos that erupted in the sky surrounding the bombers, parachutes flapped open as pilots bailed out of their aircraft. All around, black smoke mingled with the clouds as planes fell left and right. Several Messerschmitts crashed into a bomber, igniting a tumbling fireball. As bombers fell, crews parachuted by the hundreds.

In the confusion Johnson remembered his wingman and circled back to link up. He played chicken four times with a German pilot to get him to break off an attack on his wingman, sacrificing easy kills to remain grouped together.

Johnson and his wingman were the only two to remain paired throughout the conflict. Together, they dove down, chasing two FW-190s. The Focke-Wulfs had the initiative and an early speed advantage, but the stubby P-47s could dive like bricks—as their altitude fell below a few thousand feet, they were gaining.

Realizing that the Americans were about to attack, the pair of FWs split, and Johnson made the decision to bank left, following one into a tight, slow turn at full rudder. Turning inside the slowed FW, Johnson sprayed the top of the plane with shells, critically wounding the plane, which fell heavily to earth.

Climbing back to the bomber's altitude, Johnson could find no B-17s to protect, only a handful of fresh Me-109s to banter with

Photo 2-2

An M-51 antiaircraft crew watches a dogfight from the ground, the contrails painting the sky, Christmas Day, 1944.

for a few minutes. He attempted one attack run but pulled out as German reinforcements arrived. Low on fuel and ammunition, he and his wingman turned and headed back for England.

On the ground at 1:51 P.M., Johnson learned that the bombers had reached Berlin, but the American losses had been heavy. Sixty-nine B-17s were lost as well as eleven fighters. Johnson's squadron was credited with seven confirmed kills and lost only a single plane.

After the flight, Johnson suggested that the fighters fly escort duty farther off the bomber formation than was previously attempted, thereby breaking up the German offensive before it could manage a cluster attack on the bombers. On a mission the very next week, the tactics paid off. Putting a little distance between the fighters and the bombers soon became Army Air Force doctrine.

For his performance on that mission on March 6—for leadership, for taking the offensive even though heavily outnumbered, and for one confirmed enemy kill—Johnson was awarded the Distinguished Flying Cross.

Robert Johnson was one of the many aces of the war in Europe, ending his career with 28 confirmed kills. Of the Allied pilots in

Europe, most never flew more than a hundred missions, while Luftwaffe pilots often flew over 500 missions (due to fewer pilots). For this reason, the Luftwaffe's highest scoring aces scored kills in the hundreds and became expert pilots in the art of air-to-air jousting.

Taking on an Ace

Now it's time to get your feet really wet and take on a Luftwaffe ace who would like nothing more than to shoot you down. It's a true joust in the air and an opportunity to see the flying skills and get a feel for the intelligence of your adversaries in *Aces Over Europe*.

FLY SINGLE MISSION: DOGFIGHT A FAMOUS ACE: LUFTWAFFE: JOSEF PRILLER

Luftwaffe Ace: Josef "Pips" Priller, Kommodore:

JG-26 Schlageter, from 11
January 1943 through 27 January 1945;
Confirmed kills: 101
Decorations: Oak Leaves and Swords, Knight's Cross

"Pips" Priller was a strong man packed into a short, 5'4" frame and was one of the most able pilots in the Luftwaffe. He began flying in 1939 and racked up his 101 kills with regular determination until the early months of 1945. Of his kills, at least 11 were four-engined Allied bombers, while the rest were Allied fighter aircraft.

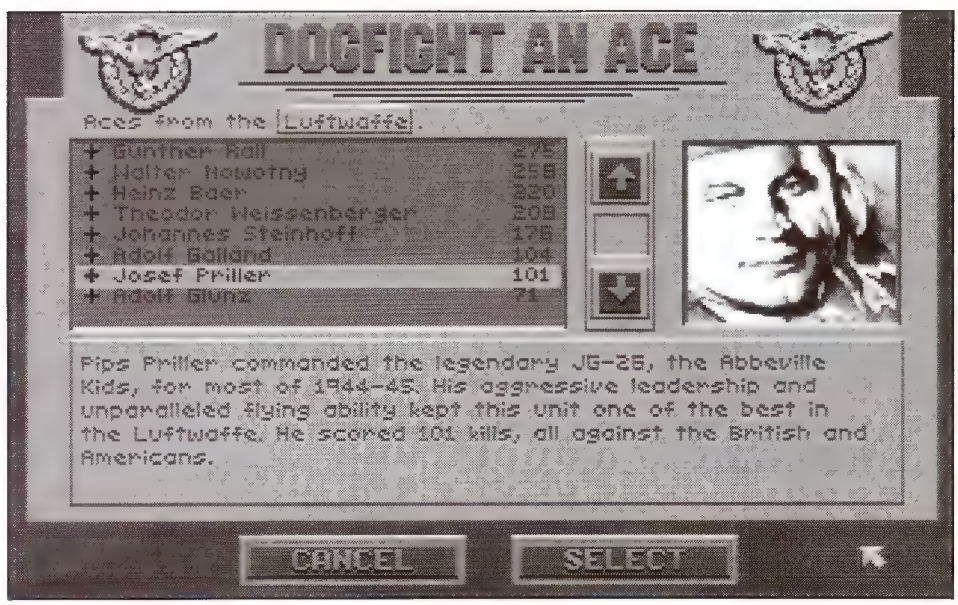

DOGFIGHT AN ACE
Aces from the Luftwaffe.
+ Gunther Rall 275
+ Walter Nowotny 258
+ Heinz Baer 220
+ Theodor Weissenberger 208
+ Johannes Steinhoff 176
+ Adolf Galland 104
+ Josef Priller 101
+ Adolf Glunz 71
Pips Priller commanded the legendary JG-26, the Abbeville Kids, for most of 1944-45. His aggressive leadership and unparalleled flying ability kept this unit one of the best in the Luftwaffe. He scored 101 kills, all against the British and Americans.
CANCEL
SELECT

Figure 2-7

Josef "Pips" Priller, Luftwaffe ace, as seen in *Aces Over Europe*'s Dogfight an Ace selection screen

Priller was one of the few members of the Luftwaffe with enough confidence to stand eye-to-eye with Goering and tell him why Germany was losing the war. He served as the commander of the JG-26 Schlageter, the "Abbeville Boys"—one of the most fearsome fighting units in all the Luftwaffe, and one which harbored aces who had racked up a combined total of well over 800 Allied kills.

Flying Your Mission

This mission will put you in a P-51D Mustang against German Ace Josef Priller, who will be flying a Focke-Wulf 190. You begin in clear weather at 22,000 feet, flying at 350 mph. Priller will be coming straight for you (neither has the element of surprise), and should appear as a dark speck in less than 5 seconds. Remember, the closing speed of your two aircraft is nearly 700 mph.

Immediately switch to Full Guns. (When going mano-a-mano against an ace, it is suicide to hold back on the firepower. Remember, in WWII most dogfights lasted far less than 5 minutes.) Throttle up to full and dive.

Hold the dive for several seconds, then pull back hard on the stick. (It's quite possible that the screen may dim a bit, indicating that you are pulling significant *G*-forces, nearly blacking out as the blood rushes to the back of your brain.) If you can get him in your sights, lay into his belly with a good burst of machine-gun fire.

If you fail to dive or perform any evasive maneuver, Priller will most certainly shoot you down (or damage your plane considerably) on the very first pass. As he flies past you, turn tight to follow. Pull into a hard turn and pull back on the stick to get more of a turning boost from your elevators. Since we are not practicing good tactics here (You will learn those soon), and since the 190 is a very similar performer to your Mustang, you also will have to apply full rudder (bank down slightly) to increase the speed of your turn to its maximum.

Since you are flying on your side (on the "knife-edge"), use the Up view to see in front of you and gauge your closing distance. If all goes well, you should be able to get Priller in your sights three or four times before your altitude gets too low. When he comes into view, he will be banking hard as well, so you will have to

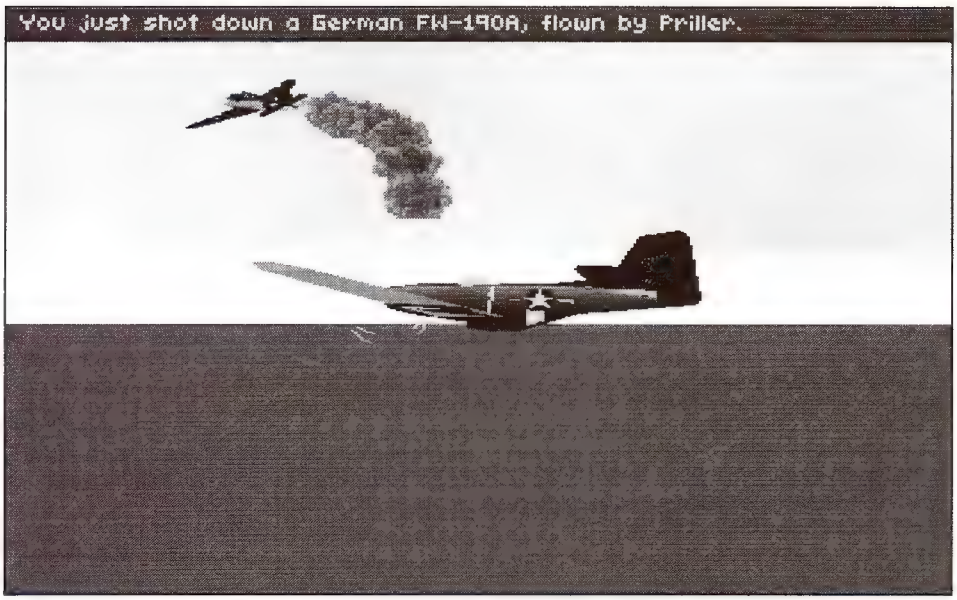


Figure 2-8

Scratch one Luftwaffe ace! "Pips" Priller goes into the drink after a dead-on shot from a P-51 Mustang.

lead your shots, shooting ahead of his travel path. This is called *deflection shooting*. It is the firing tactic that you will utilize in nearly every encounter in *Aces Over Europe*.

If you manage to take out Priller, save the mission to tape. You'll want to show off your first major kill. If he gets you, or you end up taking a bath in the English Channel, replay the mission and learn from your mistakes.

Technological Similarities

If you got into a tight spiral with Priller, you noticed how hard it was to turn inside of his Focke-Wulf 190. The P-51D Mustang can do it, but only with full elevators and rudders in a slight dive. The similarity in performance of the planes means that in *Aces Over Europe*, quick, intelligent flying skills are needed to gain a clear advantage over your opponent.

In the Pacific theater (modeled excellently in Dynamix's *Aces of the Pacific* simulation) the planes were not so similar. The Japanese planes (the Zeros, "Georges," and "Nates") were designed from the outset to be nimble performers. While it did not possess the firepower, rugged construction, or power that the American planes had, a Zero could fly loops around a Marine F4U Corsair.

This discrepancy in aircraft design meant that tactics had to be developed by both the Americans and the Japanese to take

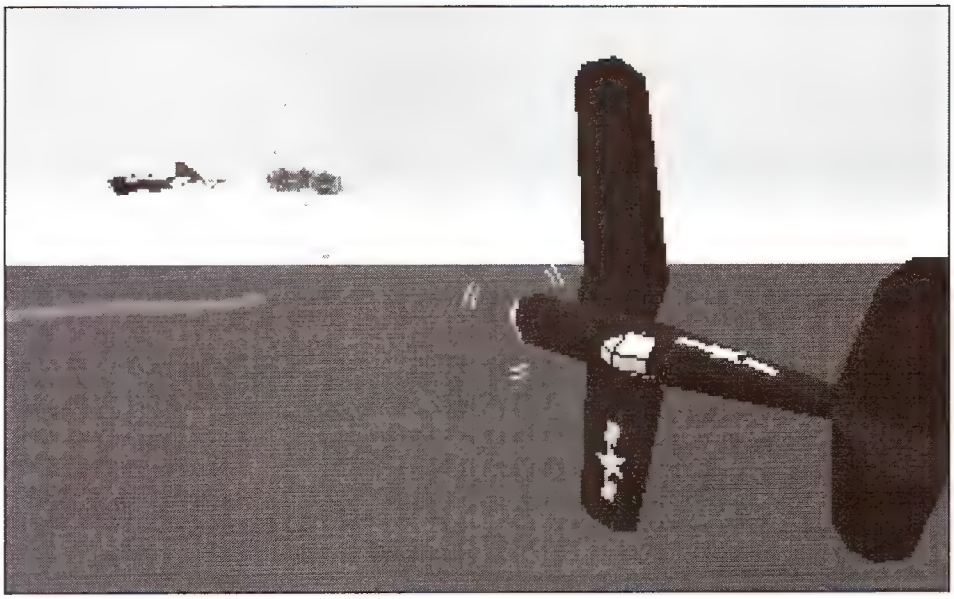


Figure 2-9

A Corsair rides a tight turn on a Zero in the Pacific theater (from Dynamix's *Aces of the Pacific* simulation).

advantage of their planes' abilities while hiding their weaknesses as best as possible. For the Japanese pilots, this meant a twisting, swerving, swarming approach, utilizing their planes' maneuverability to get behind the American planes and pepper them with machine-gun fire until they went down. Once a Corsair had a Zero locked onto his tail, it was very hard to escape.

On the American side, the planes could absorb and inflict more damage and could far out-climb and out-dive their Japanese adversaries. For the American pilots, then, the strategy of choice resembled a strafing run more than a dogfight. Using the advantage of height, the American pilot would attempt a diving attack on a Japanese plane, firing as it roared past and cutting away to a safe distance to pursue another climb-and-dive run.

Damon Slye, the designer of Dynamix's *Great War Planes* simulations, found that once he and his playtesters had mastered this dive-and-climb attack strategy, they could utilize the same tactics in *Red Baron*, the WWI simulator, with impressive results.

The tactics do not work so well, however, among the more evenly matched planes of *Aces Over Europe*. While the Pacific theater tactics were a radical departure from the twist-and-turn dogfighting style of the World War I, the European theater and *Aces Over Europe* see much more of a return to the spiraling, jousting style of air combat. Although the planes featured in *Aces Over Europe* each possess strengths and weaknesses (for a detailed, plane-to-plane comparison, see Chapter 6), they are far more similar than different. They all carry heavy weaponry, can handle

a significant amount of damage, and exhibit similar flight performance characteristics.

Therefore, you must be acutely aware of the minute strengths and weaknesses of your own and your enemy's planes. You will need to be well versed in the tactics of combat flying, both from an offensive and a defensive standpoint. In the chapters that follow, you will learn the skills and tactics necessary to be a formidable adversary, and you will get a taste of the pressures and decisions faced minute-by-minute by those who flew the planes nearly 50 years ago.

In the skies over Europe it was truly a battle, and more than at any other time or in any other theater in the history of warfare, it was the individual pilots' abilities that made the difference between scoring a confirmed kill and becoming just another wartime statistic.

Photo 2-3

A young P-47 pilot listens intently to a premission briefing.

From the Journal of Lloyd "Buster" Stinson

April 1, 1944 (Continued)

...our formation was broken. Just too many FWs to keep it firm. I pulled in on one's tail as he headed down for the bombers. He was too busy to check his six to notice me. The B-17s were firing all around us. Deep inside, I hoped those boys down there had enough sense to tell me apart from the Hun.

A few hundred feet back, and I hit him with a long shot. I knew I shouldn't waste my rounds at that range, but he wasn't pulling any evasives at all so I gave him all I had. I must have struck the oil lines under the cowl, because black smoke started belching out and he slowed down as we flew over the bombers.

I looked down—only for a moment—and saw the bombers holding tight to their formation. Their pilots must have some nerve, not breaking apart, but flying true. I'm envious of their cool, cool heads.

Close now, his wings filled up my sight glass, and I let him have another burst. Another hit, and little bits of metal came flying back, smacking off my canopy.

All of a sudden, he corkscrewed up, winged-over, and dove through the clouds. I headed down after him, but when I broke free from the clouds he was gone. Only the bombers below...

...all clear as we approached the rail yards. Just sat back, tried to relax my knotted muscles, my eyes fixed on the bombers, their fuselages a burning white in the sun. All at once, bandits again, at nine o'clock.

Before I could finish my turn, Wilson was going down. I completed my turn and drew a bead on an FW as I heard confirmations of two FWs shot down—all of that in less than 20 seconds.

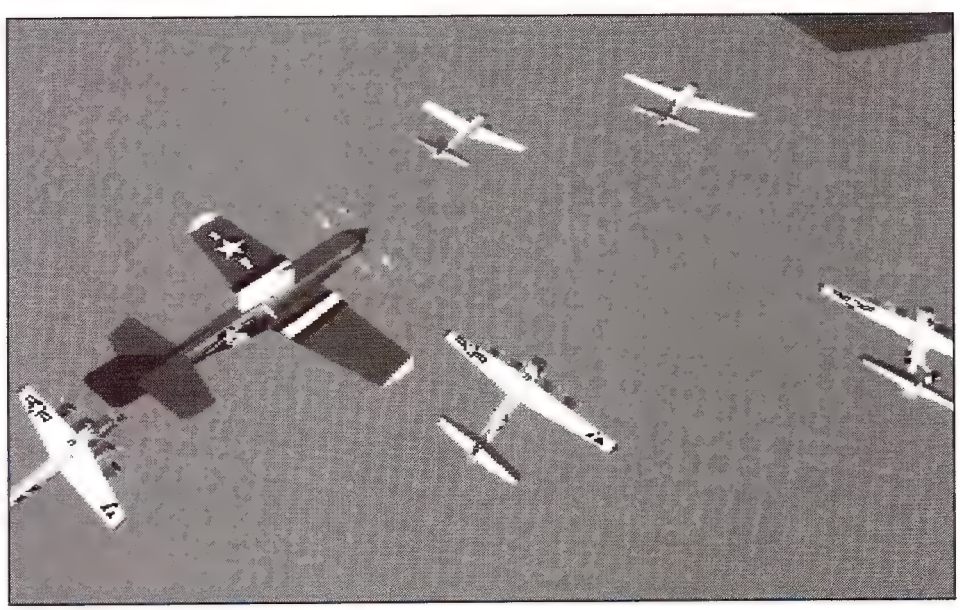


Figure 2-10

B-17G Flying Fortresses in formation, escorted by a P-51 Mustang

I closed in, full throttle, the engine making the cockpit hot and loud as I watched the Hun dive down and pull up to make a run at the bombers' bellies. Just then, another FW flew right past, and for an instant I caught a glimpse of the pilot. Young, not more than 17, he looked lost. He didn't even know I was there. I throttled back and slipped in behind, trying not to think of the look on his face as I shot a long burst.

I tried for his tail, thinking that maybe I could damage him just enough so that he'd bail out. I didn't want to kill anybody that young.

I laid six bursts on him, each a hit, smoke everywhere, and I fired through it as oil spattered and spiderwebbed across my canopy. I couldn't see clearly, and I had only 70 rounds left. I got in for one more low deflection shot, aimed with the rudder pedals, and then Mitchell dove in from nowhere, hitting him with a single shot. The Focke-Wulf went down.

...back at our base at Debden, Johnny Godfrey, one of our group's aces, pulled me aside before we went in for interrogation. He saw that first Kraut fall. My first confirmed! Interrogation lasted two hours, and I gulped coffee and peanut butter sandwiches until I was called up. Turned out that the bombers got through A-Okay and all made it back safely. As far as they could tell, they got the rail yard. All in all, the 4th took down seven bandits, and one of them was mine. Wilson went down, but Mitchell told me that he saw his chute open. I hope he made it.

A Pilot's War

While fighter pilots captured the public's imagination during World War I, with the chivalric prestige of being an ace the goal of every young pilot, the air war added up to little magnitude in the grand scheme of the war itself.

World War II, on the other hand, saw the fighter pilot as an essential component of both victory and defeat. Flying alone in the cockpit, using wits, skill, and courage, the fighter pilots escorted the bombers on their precision bombing runs against Hitler's Wehrmacht infrastructure. Because of the presence of fighters, the bombers got through and decisively turned the tide of the war.

Had the Luftwaffe seized the opportunity and had Goering possessed the wisdom he so desperately needed, the war might not have resulted in Hitler's defeat. Groups of Focke-Wulfs and Me-109s could have had a devastating effect on the air war, and on the war itself.

Unlike soldiers on the ground, where sheer numbers of individuals and support equipment were required to create an effective offensive force, a single individual in the air behind the stick of a

Photo 2-4

Five American P-51 pilots discuss their latest mission. (Note the wing-mounted droptank in the background.)

P-51D or FW-190 could make the difference between success or failure. A single pilot could take out a bridge with one well-placed bomb, effectively crippling an entire ground division.

During WWII the technology of war was put to the true test, and it was ultimately the pilots—controlling the planes which patrolled the skies—who had the ability to cast the swing vote. It was the fighter pilot's war.

The Role of the Luftwaffe

Our aces fought until they were killed.

Adolf Galland, Lieutenant General, Luftwaffe, 103 air victories

At the outset of World World II, the German aerial forces, the Luftwaffe, held every card in their favor. Many of their pilots had extensive combat experience; their tactics were tested, their leadership was driven, their fighter planes were proven performers, and they possessed a technological edge (including being close to producing a functional jet fighter). In short, the Luftwaffe held a sword to the belly of Europe; but in over 6 years of relentless fighting, that sword became rusted, bent, and useless from neglect, inexperienced new pilots, and disastrous planning. Had Germany made sensible logistic use of the Luftwaffe, history might indeed be very different.

Germany Rebuilds Its Air Power

One of the many stipulations imposed at the Treaty of Versailles, which ended World War I, was the dissolution of the German air force. Planes were destroyed, and the country was forbidden to develop aerial weaponry. Yet this did not stop the Germans. In the late 1920s, a deal was struck with Russia that allowed the German military access to a network of secret airports and training facilities within Russia. There, hundreds of miles away from the prying eyes of Western Europe, the Luftwaffe began its gestation.

The rearmament of Germany began in 1933 as Hitler took power over his Reich. Meeting with his generals, he persuaded them that some time in the near future France would take up war against Germany. To counter this, it was imperative that Germany rearm itself in preparation against any attack.

One of the main branches of this rearmament was the Luftwaffe. This aerial branch of the German military was placed under Hermann Goering's control. His place as Hitler's second-in-command ensured that the Luftwaffe would receive the funding it needed, despite the crippling depression which fueled Germany's flames of fascism.

By 1935, the Luftwaffe consisted of 900 flying officers, 200 antiaircraft officers, and 17,000 enlisted men. Most of the men in the Luftwaffe were taken from the ranks of civilian aviation, with flight veterans of the First World War filling out the officers' levels.

Photo 3-1

Adolf Hitler salutes a parade of SS troops, 1935.

Growth of the Luftwaffe

The first vision of the Luftwaffe was presented by Dr. Robert Krauss, who felt that a deterrent force of 400 four-engined bombers was the ticket to stability. He reasoned that a "more disciplined" totalitarian state of Germany could stand up to strategic bombing better than either the French or British democracies, and a strategic bombing campaign against the industrial infrastructure of both countries would cripple their military and break the morale of a "less disciplined people." This idea was scuttled when Germany proved not to have the industrial expertise or facilities to produce such a bombing fleet.

Hermann Goering

Goering himself was a fighter pilot of some renown, scoring 22 victories in the First World War and rising to the command of

Photo 3-2

Reichsmarshall Hermann Goering

the "Richtofen Circus" after the death of the "Red Baron," Manfred Von Richtofen. Goering's supreme confidence in the infallibility of an air force was in marked opposition to his technical knowledge or his ability to get the job done. Although he was an aggressive personality, his leadership ability often proved flawed. During WWI, the loss of both pilots and planes rose sharply after he took control of Richtofen's group.

In addition to being a decorated pilot in WWI, Goering was active in Germany's politics and was elected to the Reichstag (Germany's political body) in 1928. In 1932, a year before Hitler came to power, he was elected as the body's presiding officer.

When Hitler took on the title of Feuhrer of the Third Reich, he named Goering as his successor and Rudolf Hess as the next in line. Goering was the driving force behind the growth of the Luftwaffe, and his enthusiasm and connection to Hitler ensured a rapid development. Goering was not an engineer or a logistical expert, however, and his vision for the Luftwaffe was limited to mere production numbers. For Goering, the details of design and deployment were unimportant nuisances meant to be handled by his underlings. What he wanted during the prewar years of Germany's rearmament was report of great production. Goering wanted numbers "to impress Hitler, and to enable Hitler, in turn, to impress the world."

Despite a muddled and chaotic organizational plan, the Luftwaffe did manage to move forward the design and development of several key planes, the most important of which was the second generation Messerschmitt 109 single-seat fighter.

Goering's Great Lie

In the latter years of the war, as the attrition constantly afflicted by the Allied airforces eroded away at the Luftwaffe, Goering fell out of favor with Hitler, and his normal energetic manner became more chaotic and irrational as he succumbed to an ongoing morphine addiction. Finally, ousted as Hitler's successor, Goering had no choice but to place blame for Germany's loosing effort—incorrectly—on the pilots of the Luftwaffe.

In "Goering's great lie," he blamed the individual weaknesses of the Luftwaffe fighter pilots for the destruction wrought on Germany from the B-17s above. As he pressed this fact—that the pilots were weak, soft, and cowardly— the German citizens began to believe it, blaming their country's fall into chaos on the

few individuals who piloted the Me-109s, Focke-Wulf 190s, and Me-262s. For years after the war, Luftwaffe fighter pilots were ostracized because of Goering's scathing indictment of their abilities.

In truth, blame fell more on Goering's own shoulders than on the pilots of the Luftwaffe. They fought to save their families from the destruction of the strategic bombing campaigns and endured countless missions (often hundreds more than their Allied counterparts) against overwhelming odds, but their efforts had been sabotaged years before by poor leadership and planning.

Reichsmarshall Hermann Goering was captured by the Allies in 1945 and tried as a war criminal by the International Military Tribunal at Nuremberg. He was convicted and sentenced to death and on October 19, 1946, the eve of his execution, he cheated the hangman by taking a lethal dose of poison from a capsule that he had kept hidden since his capture, ending his own life.

The Luftwaffe Readies for War

The initial strategic purpose for the Luftwaffe, according to Hitler's address to his generals, was to create a deterrent force to keep Poland and France from launching a preemptive attack on

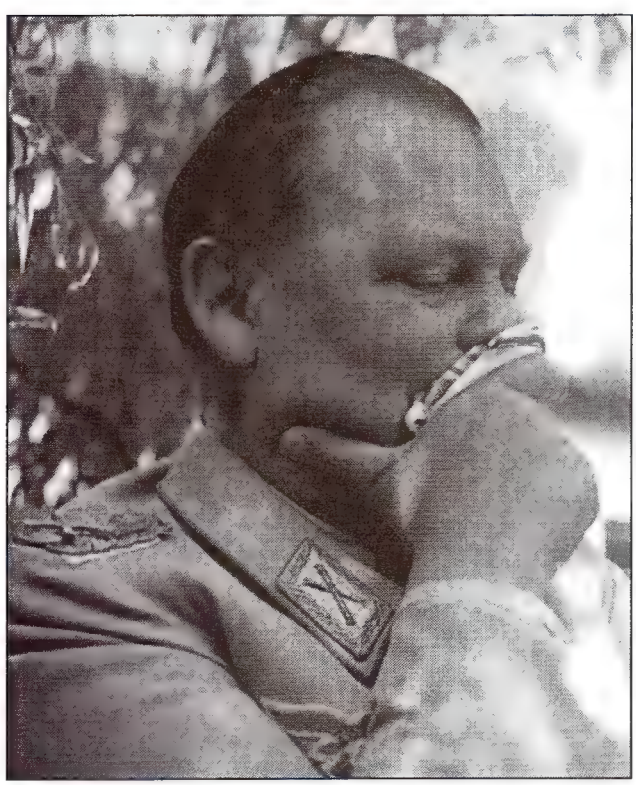


Photo 3-3

Goering shows visible signs of stress at a press conference one day after his capture, May 9, 1945.

Germany. In actuality, the need for a deterrent really did not exist. Hitler's initiation of a nonaggression pact with Poland in 1934 effectively cut the East out as an immediate threat, and until 1937, the French saw themselves as supremely able to deal with the Luftwaffe, should the need arise.

The French had armed their border with Germany, the Maginot Line, with a "veritable forest of guns," and therefore saw any threat of aggression by Germany as suicidal foolishness. The Luftwaffe also acquiesced to this view, feeling their operational fighting force was far below the capabilities of the French air force. It was not until 1938 that the Luftwaffe had begun to realize its potential.

By 1937, the Luftwaffe had developed the Messerschmitt Bf-109B fighter, as well as the He 111 and Do-17 bombers, and preliminary work was already underway on a plane powered by jet propulsion.

The Spanish Civil War

As the Spanish Civil War erupted between the Nationalists led by General Francisco Franco and the Loyalists, Hitler envisioned the Civil War as a double-edged opportunity for Germany. It was a diversion for Western Europe, distracting its attention as Germany increased its military buildup, and it was also an opportunity to field test the strategies and weapons of the Luftwaffe.

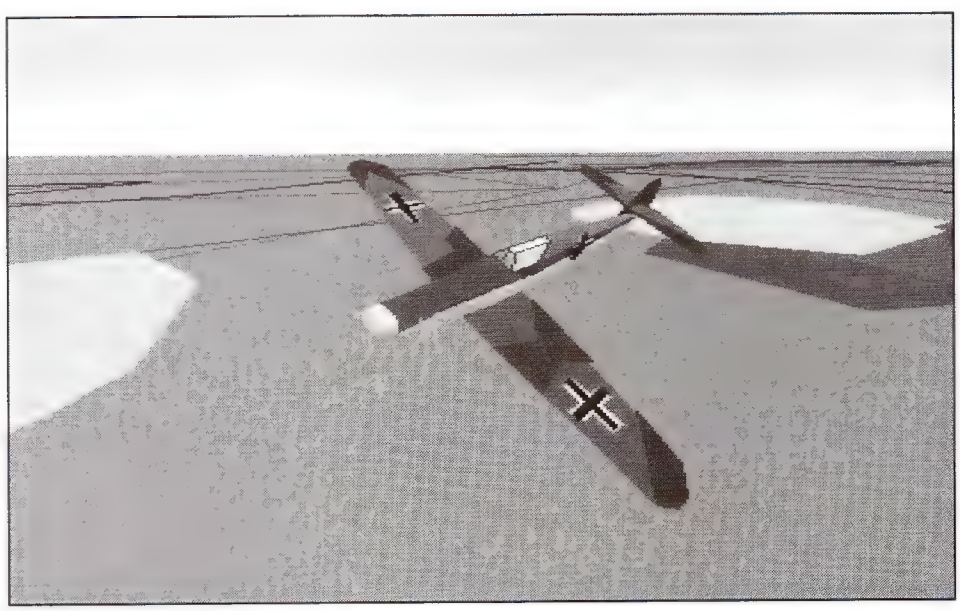


Figure 3-1

A Messerschmitt Bf-109 flying over clouds in *Aces Over Europe*

For the young Luftwaffe pilots, many of whom had volunteered, fearing a coming draft as Germany moved to wartime mobilization, it was a chance to test their mettle in aerial combat. The pilots—including Adolf Galland, one of the Luftwaffe's greatest aces—flew for Franco in Bf-109s, building up experience and giving the Luftwaffe engineers field test results that would have taken years to achieve without combat activity.

The Bf-109 Goes through Its Paces

At once the pilots took a liking to the 109s. These new planes felt like second skins, as if they had become one with the pilot. For many of the pilots, this was the first true war plane they had flown. Training had taken place in biplanes (or "double-deckers" as the Germans called them). For the WWI veterans, the new mono-winged plane was a mighty war stallion compared to the flimsy canvas-on-wood planes they had fought in before. The pilot and the plane became a single unit, and as Luftwaffe ace Walter Schuck remembered, the connection was so intuitive "When the pilot became nervous, so did the plane." The affection the pilots had toward the early versions of the Bf-109 remained for the rest of the war, even after their technology had become hopelessly outdated. The far-superior Focke-Wulf 190 was not a favorite. For the pilots, it "flew like a bus."

During the Luftwaffe field exercises known as the Spanish Civil War, it became clear that the planes needed improvement. The Bf-109 had several major problems. The armament consisted of a 20-mm cannon that fired through the propeller disc but was fond of seizing up at the most inopportune moments. Several later versions of the plane were armed instead with twin machine guns mounted on the wings, but the vibrations proved problematic. The tail of the plane was unstable and buffeted during even modest diving attacks, and the wings fluttered during flight. More attention to balancing the ailerons and stiffening the mono-wing's leading edge solved the problems.

From the Journal of Gerhardt Lichter

1st Lieutenant, June 7, 1936

...Commodore Galland issued our orders today, my 19th birthday. For two years I have trained to become a pilot. It was my father's wish that I join Goering's Luftwaffe, to

bring honor to my family. I have trained on the He-51 for 9 months, and now it will be my weapon.

Senior pilots, those who fought honorably through Germany's humiliation 8 years ago, will fly the new Messerschmitts, but our group are freshman. We have not yet earned our wings...

...the plane bucked as we flew low, the turbulence howling off the upper-decker wing. Below us were trenches dug by the Republican troops; I could see the sweat on their dirty uniforms as we flew over.

For some reason, they did not shoot up at us as we released our ordnance. Flambos, 10-kilo matchsticks of oil and gasoline that explode, were running away from the trenches as we pulled in behind. Tilting the nose down, I opened up fire, strafing them to the ground. The Republicans fell like dolls as we pulled away.

Heading back to our airdrome, I wiped the oil from my face. It smelled hot, victorious. I am glad I will be a pilot for Hitler's revenge on the world...

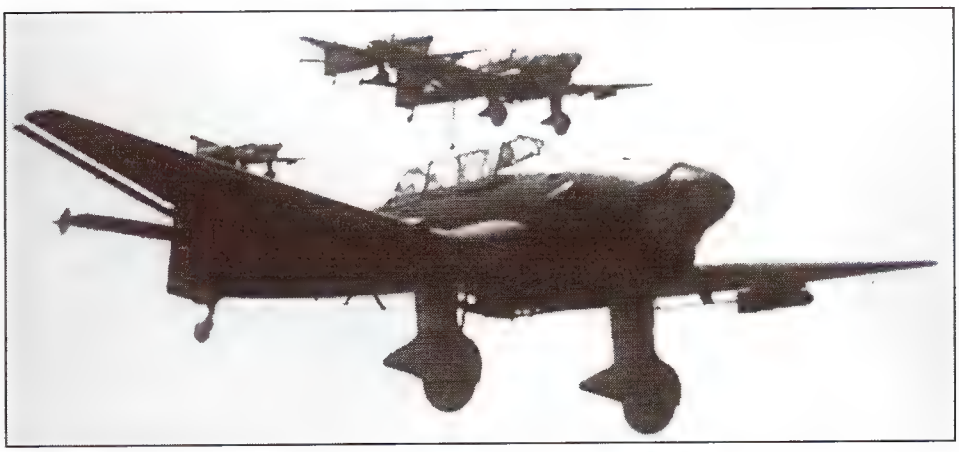
Blitzkrieg

On September 1, 1939, the floodgates fell open, and Hitler's Wehrmacht was ready for war. The stage had been set. Two armies, filled out with over 1.5 million loyal soldiers, supported by a multitude of panzer divisions and the most advanced air force in the world, set their sights on Warsaw, the Polish capital.

Bombs rained from the sky as Stuka dive-bombers placed their ordnance with pinpoint accuracy, and tanks blasted through the Polish lines. Warsaw then fell victim to a vicious bombing campaign, and within 4 weeks Hitler's military might had utterly destroyed Poland's resistance. Blitzkrieg, or Lightning War, was Hitler's term for his Wehrmacht's massive, offensive punch. His army was spearheaded by deadly panzer divisions, protected by

Photo 3-4

Stuka dive-bombers, with odd, nonretractable landing gear, produced a terrifying scream when the planes dove upon their targets



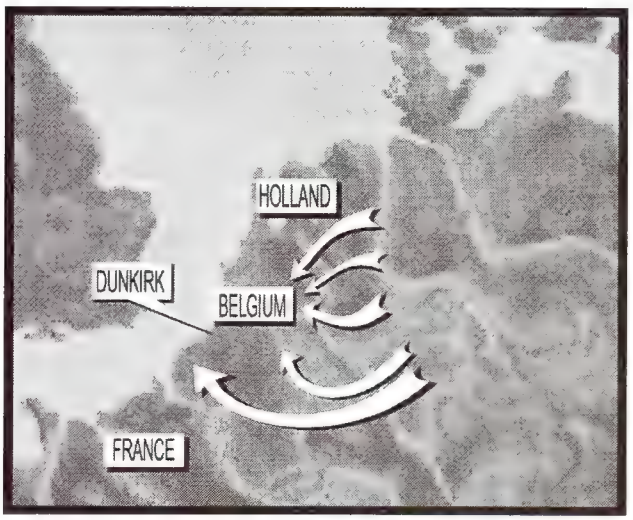


Figure 3-2

Map showing Hitler's plan for the initial invasion of Western Europe.

an iron umbrella above, provided by the Luftwaffe. Working together, the ground and air forces combined into a high-speed force of nearly unstoppable power.

In the campaign against Poland, the German losses were low: 11,000 dead and 30,000 wounded, while the Poles suffered 70,000 dead, 130,000 wounded, and three-quarters of a million prisoners. As Goering congratulated his Luftwaffe pilots and echoed Hitler's words that the Fuehrer had conquered all he had planned to conquer, Hitler was drunk on the possibilities of his Blitzkrieg strategy.

Already Hitler was laying out the plans to take his Wehrmacht into Western Europe, to exact a toll of revenge against those who had crippled Germany with the Treaty of Versailles and also to capture supply-rich territory to feed Germany's sluggish yet voracious wartime economy. He envisioned the war as a series of lightning-quick saber slashes, his Blitzkrieg cutting down foes before they even had a chance to react.

Goering shared Hitler's zeal for the Blitzkrieg strategy, and the industrial production of the Luftwaffe geared up in an attempt to produce huge quantities of fighters and twin-engined, short-range bombers. (Since the Blitzkrieg was a constantly moving force, range was an unneeded luxury for the Luftwaffe.)

Although Hitler was eager to wage an autumn war against Western Europe, the German economy, the words of his advisers, and the coming winter forced him to wait. The Luftwaffe did not wait for spring idly. For the Polish campaign, the Luftwaffe possessed just over 4000 aircraft, of which 1200 were fighters and 1000 were bombers. By April 1940 those numbers

had increased to 1600 fighters and 1800 bombers. The Luftwaffe was ready to take the war to the west.

Germany Conquers the West

On April 7, 1940, the German land, air, and sea forces struck towards the west. Within hours the Danish resistance had collapsed. During the western offensive, lessons learned in the Spanish Civil War showed their merit. Previously, the role of the Luftwaffe had been one of small-scale tactical operations—flights of twin-engined bombers striking against pinpoint targets of military value. Paired with this was the philosophy that terror bombing against the civilians of the "lesser disciplined" western countries would bring them to their knees. The fighter corps was meant as support or a shield to neutralize the enemy's airborne resistance.

It was easy for Goering to hold firm to this view as he measured the technological development of the German fighters at the outset of the war and the German pilots' rigorous training and combat experience.

During the Spanish Civil War, however, a lesser priority of the Luftwaffe came to light. Under the command of Field Marshal Wolfram Von Richtofen (the WWI ace's cousin), the Luftwaffe learned the value of "close air support." By working in tandem with the ground forces, the Blitzkrieg developed into a fearsome weapon.

By early 1940, the French air force was in a state of poor operational readiness, with less than 40 percent of the units flight-ready.

Photo 3-5

Young Lieutenant General Adolf Galland, here shaking hands with the Fuehrer, was perhaps the Luftwaffe's most shrewd and gifted tactician and leader.

On May 13, the Luftwaffe, chiefly behind the deadly accurate cover of Stuka dive-bombers, crossed the Meuse River into France. The Luftwaffe was to supply continuous support rather than launch one or two large-scale attacks. By pummeling the French reservists who held the line, the French infantry couldn't keep an eye on the German ground forces. The Germans had secured the bridge by nightfall, and by the 15th, Hitler's panzers had a clear run to Abbeville. The use of the Luftwaffe in a ground-support role proved to be the vital key in one of the most decisive strategic victories of the twentieth century.

While the simulation does not start until the last months of the war, when the level of air conflicts reached its zenith, creatively setting up the parameters of the single mission options will allow you to get a taste for the type of combat and flying encountered early in the war. Remember that the planes you will be flying in Aces Over Europe *are much more refined versions than were flying in 1940. Setting up one of these "theoretical missions" will not give you the true historical accuracy of the standard* Aces Over Europe *missions.*

As Germany began its campaign through Belgium and into northern France, the French air force was a factor, but only a minor one. The French pilots fought bravely, but they were caught unprepared and were out-gunned by the superior weaponry of the Luftwaffe.

In northern France, the French army, the British Expeditionary Force, and the Belgian army faced a situation of utter hopelessness and were forced to retreat. Special units of the RAF were on hand to attempt to stop the Luftwaffe's Me-109 and Me-110 raids and to protect the ground forces as they retreated.

Outfitted mostly with Hawker Hurricanes, a capable but inferior fighter in the face of the Luftwaffe's planes, the RAF pilots struggled with daunting odds and technological limitations. The Hurricanes, whose fuel system was gravity fed, could not maneuver as tightly as the German planes and could not sustain inverted flight without the engine cutting out. For approximately 2 weeks, from the time the Germans crossed the Meuse until the cornered Allied troops were forced to evacuate at Dunkirk on May 26, 1940, the RAF fought countless sorties against fighter groups of roaming Bf-109s.

The Luftwaffe pilots, many of whom had flown in combat before, either in WWI , the Spanish Civil War, or Poland, had a

very clear edge over the forces of the RAF. Also, the Bf-109s were superior stressed-skin planes, more agile and rugged than the canvas-over-metal fuselaged Hurricanes.

Flying for the Luftwaffe

By setting up a squadron mission in *Aces Over Europe*, you roughly get a feel of what it was like flying for the Luftwaffe in mid-1940 when its aerial dominance was clear. Remember that the planes you will fly and fly against in *Aces Over Europe* are later evolutions of the planes of 1940, with better handling and fire-power capabilities. The Spitfire, which was in light production in England and was not to be seen in Western Europe for several months, was a far superior fighter than the Hurricane.

FLY SINGLE MISSION: DOGFIGHT A SQUADRON: LUFTWAFFE: FLIGHT (FOUR: YOURSELF, VETERAN, VETERAN, EXPERT): BF-109G: FLIGHT (TWO: REGULAR, NOVICE): SPITFIRE IX: LOW ALTITUDE: NO ONE: MOSTLY CLOUDY

This mission places you as the wing leader of four Me-109s, flying the lead position of the German "Schwarm" formation. You can view the formation and other details about your mission by selecting the Preflight Options screen.

You should note that the Dogfight a Squadron missions take place on a randomly selected date. Ignore the date, but it is interesting to view the Flight Map at the different dates, noting the decline in western German positions after D-Day.

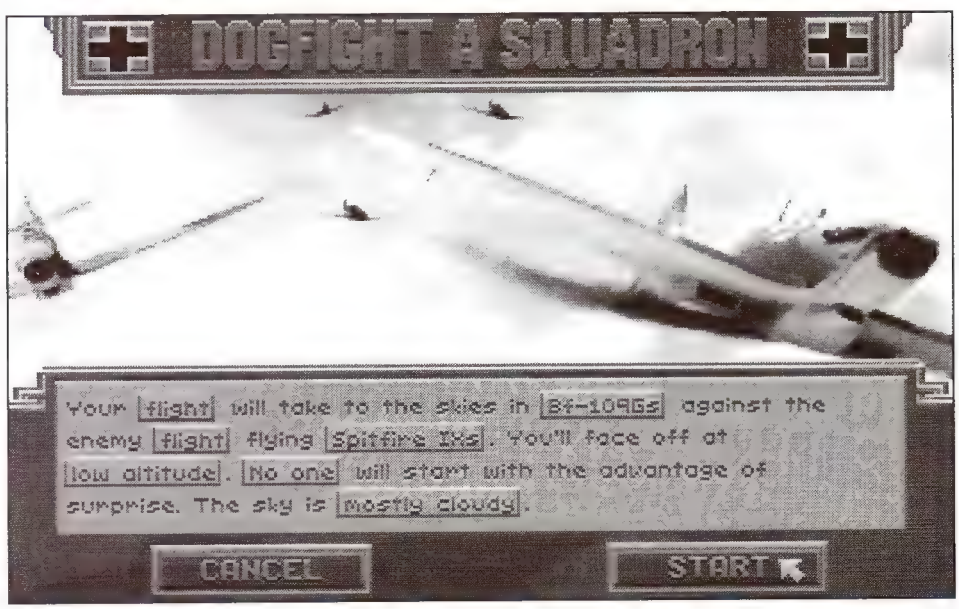

DOGFIGHT A SQUADRON
Your flight will take to the skies in Bf-109Gs against the enemy flight flying Spitfire IXs. You'll face off at low altitude. No one will start with the advantage of surprise. The sky is mostly cloudy.
CANCEL
START

Figure 3-3

The Mission screen for a squadron dogfight

The mission is set for low altitude since most of the German sorties were along the line, either seeking to take out a ground position or to tangle with RAF planes that were defending the lines.

The "Schwarm" formation is similar to the basic Allied four-plane, Finger Four formation (developed during the Battle of Britain), which afforded the greatest visibility and protection. Since you are flying as wing leader, your wingman—or flying partner— begins the mission to your left.

As soon as the mission starts, you receive the words "Bandits at 12 o'clock." Since neither side has the element of surprise, you can assume that the RAF pilots will see you at the same time you see them. Immediately throttle up to maximum, select Full Guns (machine guns and cannon firing simultaneously). Fly straight and level until you can make out their wings. Dive down slightly (to avoid their bullets) and pull up as they break left and right; try to place some lead into one of their bellies.

Since you have not learned dogfighting tactics yet, your two main tools of flight should be the tight-banked turn and the weave. Both the Bf-109 and the Spitfire have similar rates of turn, but if you pull full rudder and can stand the *G*-forces, you can generally turn inside them.

For this mission, do not worry about the others in your flight. They are experienced pilots and have an advantage in skill and numbers over the Spitfires. Instead, concentrate on selecting a target and getting in behind.

Figure 3-4

An RAF Spitfire breaks away from a Bf-109 after a head-on pass came up empty.

As you fly, remember to keep a watchful eye on your temperature gauge, throttling down to 80 to 90 percent when the warning light illuminates.

In a tight bank, use the Look Up view to see ahead of your plane and to gauge when you are closing in on an enemy Spitfire. After several tight turns, the Spitfire will probably break to flee. This is your cue to pull gently out of your turn, throttle up, and close in for the kill. Since the RAF pilot will be a novice, his evasive maneuvers will be fairly limited.

As you close in, test out your firing bursts to get a feel for how much you will have to lead the plane (called *deflection shooting*, covered in Chapters 4 and 8). Your object is to pull close enough so that the Spitfire's wings fill or spill past your etched-glass aiming reticule. When this happens, go in for the kill, firing in whole-second bursts, pausing to anticipate any evasive maneuvers, then continuing.

If you manage to hit an oil line or the engine, black smoke will begin to pour from the plane, so try to position your Bf-109 to the side in order to get a clear shot.

After you down the plane (should you be shot down, simply select Replay Mission to have another go at the Spitfires), you should receive word soon that your other flight has downed the other Spitfire. Turn your view Left or Right. You will notice that your wingman (if he has not been shot down) is still at your side. To end the mission, tap the Esc key.

Figure 3-5

A Spitfire goes down under a hail of bullets from several, more experienced Luftwaffe pilots in Bf-109s.

If all went well, you should receive the message: "The enemy flight was sent down in flames, and all members of your flight survived! Your mission was a complete success!"

Try this mission again from the RAF side of the coin and restrict your flying so that you don't allow your plane to bank too steeply, and don't attempt any inverted flight. You can then get a feel for how dangerous it was going up against the Luftwaffe.

Flying for the Luftwaffe in Aces Over Europe *is certainly one of the most challenging aspects of the game. By the time the simulation begins on April 1, 1944, several weeks before D-Day, the relentless Allied bombing of Germany's wartime infrastructure has reduced the Luftwaffe to a shadow of its former self.*

The Luftwaffe pilots were still the most experienced in the sky, but the odds that they were forced to operate against were a burden beyond their abilities. When choosing to pursue a career in the Luftwaffe, be sure that you are well versed in the grammar of dogfighting, never forget your evasive maneuvers, and attempt to surround yourself with as many expert pilots as possible. Also, do not be afraid to flee. A pilot who runs for his life will live to fight again another day.

The RAF in France

Even though the Royal Air Force was outgunned, outexperienced, and outnumbered by the Luftwaffe pilots, it put up a strong resistance for the 2 weeks before Dunkirk. RAF squadrons flew

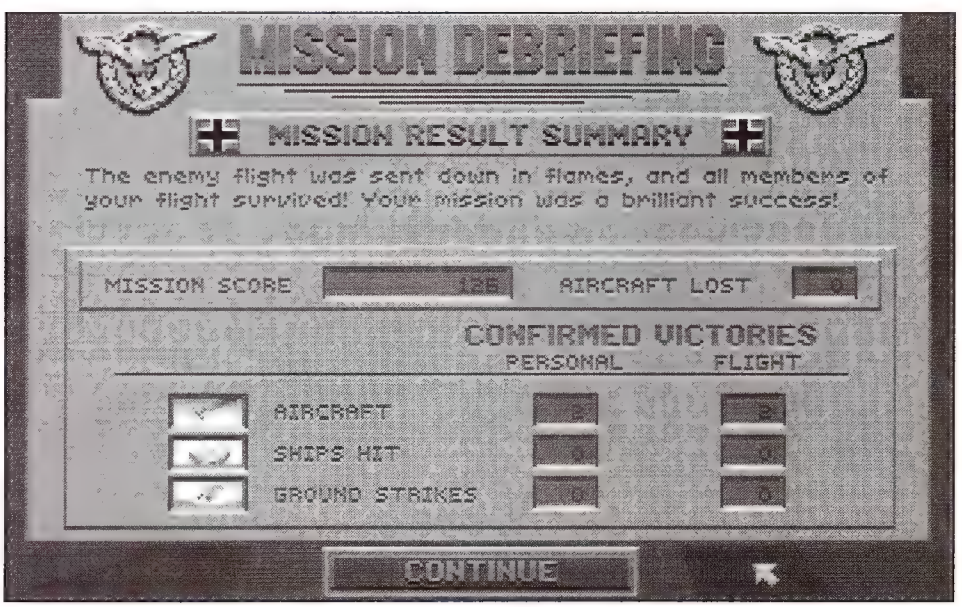


Figure 3-6

Debriefing screen in *Aces Over Europe,* displaying the results of the mission and your point score

countless missions, pausing only to refuel and repair and relocate their bases. The pilots fought off exhaustion and extreme fatigue as they took out a surprising number of Bf-109s and He-111s.

They also garnered valuable combat experience, learning from both the Germans and the French, and the pilots brought those skills back to England in the Battle of Britain.

In the end, though, the sheer numbers of Hitler's fighter planes and bombers overwhelmed the tenacious RAF and the unprepared French Air Force. It was a 2-week war of experience and aerial firepower, and the Luftwaffe held all the trumps. It was only a matter of time before victory could be secured.

Dunkirk

By the 23rd of May, Germany's panzers had nearly completed their dash across Belgium and northern France. It was clear that the French First Army, the Belgian army, and the British Expeditionary Force were trapped. They began their retreat to the beaches of Dunkirk.

The panzers stopped short of overrunning the Allies, partly because they had reached a primary goal and the crews and foot soldiers needed a rest. It was Goering who factored into the equation next. Supremely confident of the Luftwaffe's rout of the French air force and the British Expeditionary Force (and seemingly ignorant of the losses the Luftwaffe incurred), he boasted that the Luftwaffe could finish the job.

In reality, the Luftwaffe was unprepared for this massive task. The hordes of Stuka dive-bombers were badly in need of repairs, and the pilots were overworked. The German medium-range bombers still flew out of bases in Germany, and Dunkirk tested the limits of their range.

On the other hand, Dunkirk was close enough to fighter bases in England that the Hurricanes and the newer Spitfires could fly cover over the massive seaborne evacuation. In the 9 days of the Dunkirk evacuation, the RAF lost 177 aircraft—matched nearly plane for plane by the Luftwaffe.

Although the German Blitzkrieg had succeeded in routing the Allied forces from Western Europe, for the first time in nearly a year the Luftwaffe had lost unquestioned air superiority. This loss resulted in a psychological wound that left Goering reeling, scrambling for an explanation.

Photo 3-6

Hitler presents a medal to a victorious Luftwaffe pilot. Note the sharp shadows from a flash camera, indicating that this was probably a staged publicity photo.

Just before the June 22nd armistice that essentially gave Europe to Germany, Britain declared war on Germany. Winston Churchill's words foreshadowed the events to follow: "The battle which General Weygand has called the Battle of France is over. I expect the Battle of Britain is about to begin."

Preparing to Fight—Flight School

Find the enemy and shoot him down; anything else is nonsense.

Baron Manfred Von Richtofen, 1917

To earn the right to sit solo behind a throbbing, 2000-horsepower, supercharged engine armed to the teeth with cannons and machine guns, a pilot had a long road to traverse. Beyond a simple weapon such as a .45 or a mortar, a fighter plane was huge, temperamental, and operated in a three-dimensional world buffeted by a veritable armada of constantly changing situational and environmental variables.

Fighter pilots for both the Allies and the Axis had to be prime physical specimens, gifted with lean, strong bodies, keen eyesight, and a constitution immune to motion sickness and fits of nausea. On the mental side of the card, a pilot had to be a quick thinker, aggressive, able to calculate trajectories on the fly, be endowed with nearly photographic memory, and have a skill for math and number crunching.

It was a tough order to fill. In the early war (before the demand for pilots became very high), a potential pilot couldn't even begin training without perfect health and at least 2 years of college. Even with these restrictions, perhaps only 25 percent of those who started training ended up on the business end of a P-51 control stick.

For Hitler's Luftwaffe the early restrictions on being a fighter pilot were even stricter than for British or American cadets. The flyers of the Luftwaffe had the legends of WWI to live up to.

Even though Germany suffered defeat in the Great War, the memory of aces such as Richtofen—the Red Baron—still resonated. For a young German, being a civilian pilot for Lufthansa held no glory. Fathers urged their sons to try for more, to seek glory in the skies like Richtofen had done before them.

Flight Training

Learning to pilot an airplane has never been an easy affair. The complexities of flight require a student today to undergo hundreds of hours of training—from ground school, where fundamentals of flight are taught, to flying with an instructor, to finally logging solo hours. If you add to that a strict regimen of physical training, memorization of countless facts, flight aerobatics, and combat tactics, you have a good picture of what it was like in the training camps 50 years ago.

Cadets began their training knowing that they were there to learn to fly. At the first stages of training, however, they still did not know whether they would fly fighters, bombers, observation planes, or transports. All the glory rode with the fighter pilots—perhaps a romantic holdover from the previous war—and the Army did its noble best to continue to foster that romantic notion to motivate the young cadets. One flight cadet, Tom McManus, clearly remembers preflight training, when he and his fellow students were learning cadence on the second stop of their whirlwind education. He had flown only once before as a passenger when another student was logging some solo hours, but the true allure of becoming a fighter pilot was a hazy and abstract dream.

While the cadets were in the hot summer sun, a low rumbling came over the trees; they stopped in their tracks. The drill sergeant said nothing. As they shaded their eyes in order to see, just above the tree tops—not more than 50 feet above the ground—three P-47 Thunderbolts came roaring, their giant engines sending tremors across the PT field. The awestruck cadets watched them pull up sharply, climbing straight up while performing synchronized barrel rolls. From that moment on, the young cadet was hooked. More than anything else in the world, he wanted to become a fighter pilot.

The stunt was staged, of course, an exercise in morale building that created exactly the desired effect. Seeing the planes rumble

over the pine trees ignited the fire in many cadets' bellies, causing them to focus on their goals and work as hard as possible to make them reality.

Fundamentals

For Army Air Force cadets, training began in a preparatory school where basic classes were taught and physical development was the primary goal. The prep program was a means to weed out those cadets who could not handle the rigors ahead. Athletics filled every afternoon, and course work occupied every morning. They studied spherical trigonometry, the mechanics of flight, navigation, aerology, recognition—and, of course, military doctrine.

Cadets had to score well on recognition, and tests were commonplace. For those tests, the students were often seated in a dark room, and an opaque projector was flipped on. For only an instant, the silhouette of a plane was projected on the wall. The cadets had to know what type of plane it was, friend or foe. Often, if cadets couldn't score 90 percent on recognition, they were on their way out.

Preflight Training

After preparatory courses, the cadets were often moved to preliminary training bases, where they delved more deeply into

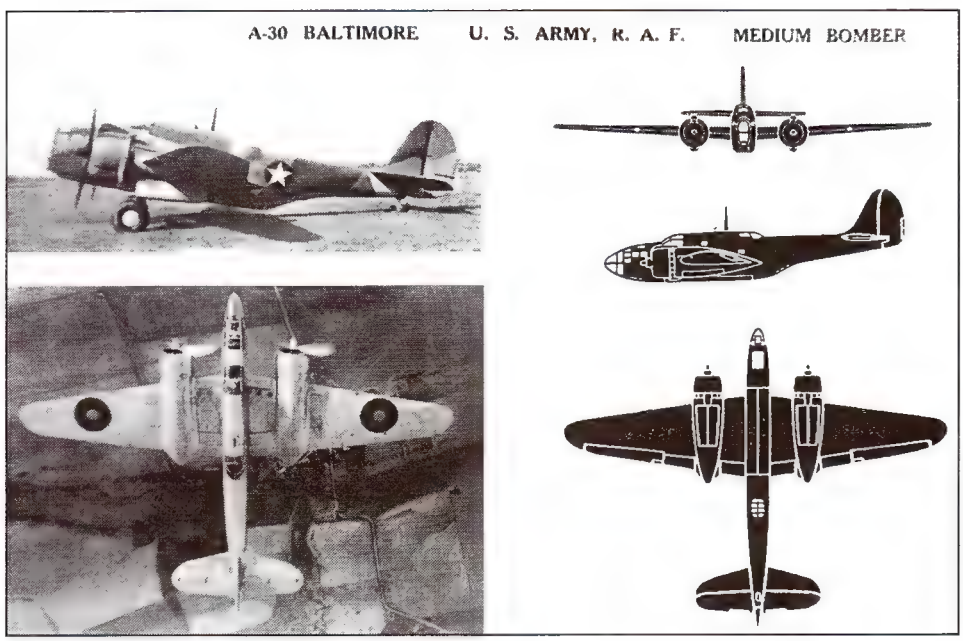


Photo 4-1

Flight training required the memorization of silhouettes of dozens upon dozens of planes. Here is a study sheet for recognition of an A-30 medium bomber.

military training. They learned marching in cadence, firing a handgun, hand-to-hand combat skills, and more about flying. They practiced Morse code and were expected to pass a proficiency test, demonstrating their ability to tap out 10 to 20 words per minute.

They studied actual airplanes and took several flights. At preflight, the cadets were given an option of selecting their desired duties. Although their choices were not guaranteed, the cadets now had incentive to live up to the qualifications of their choices. By the time the cadets left preflight and entered flight school, their numbers had been cut in half.

Young Pilots Take to the Air

In flight school (first basic, then advanced) the cadets turned from bookworms into pilots. During wartime, training began immediately, and by the third day the cadets were flying in twin-seat airplanes with flight instructors. The first phase consisted of basic flight instructions from turns to takeoffs and landings. Each flight would last for roughly 1 hour, and at the end of each phase—perhaps 5 to 10 days of instructor flights—the young pilots would go up on a check flight. They would be observed by another officer who checked their progress and double-checked what the other instructor had done. After the check flight, the pilots would wait in the ready room to see if their names were

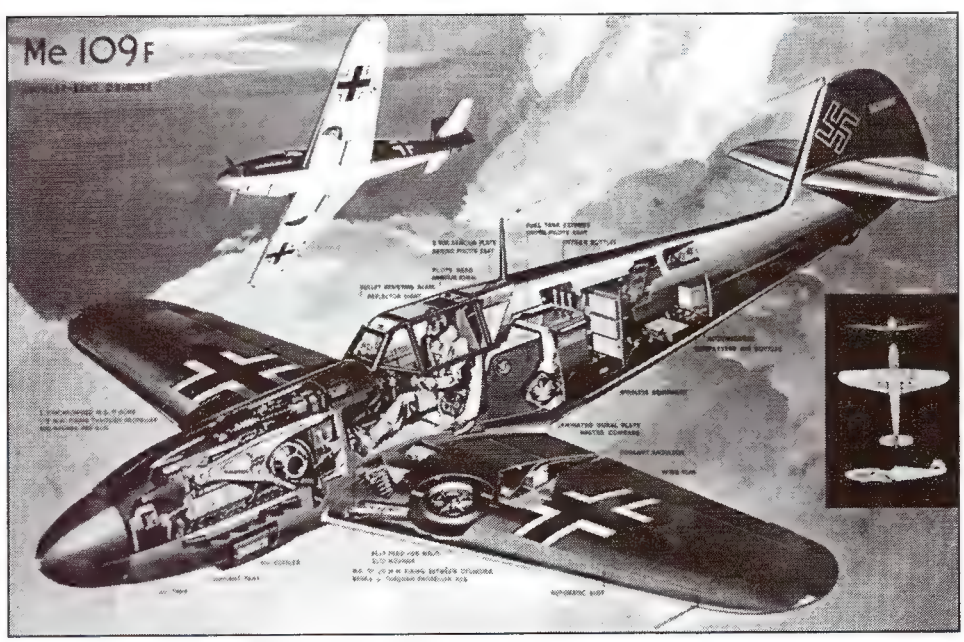


Photo 4-2

Cadets also studied the enemy's planes. This is an RAF study guide on the Messerschmitt 109.

marked with an up arrow, indicating that they could solo, or with a down arrow, which meant that they had to pass the same review two more times.

Solo

For most cadets, the first solo is still a vivid memory. Free for the first time to take off, fly, and land on their own, they were allowed an hour to break free of the rigors of Army training and experience the motivating thrill of flight. It is hard to imagine any pilot—Luftwaffe, USAAF, or RAF—in the air that first time pondering the immensities of the task that lay ahead, the facts and figures of campaigns and battles that were happening on a front hundreds or thousands of miles away.

The air was cool and clean. As they watched their bases shrink to a mere scratching of runway lines on the ground, they must have felt a great sense of accomplishment and awe. In many of the training planes there were no radios, so the environment was

Photo 4-3

Navy flight cadets, like their Air Force counterparts, wait anxiously for their afternoon flight assignments.

secluded and therapeutic. Listening to the deafening drone of the mantralike engine, the young pilots remembered why they had come to this place and dreamed of how they would make their families proud.

Training Intensifies

After they had mastered basic flight skills, the pilots learned crosswind landings, emergency procedures, landing on target, and more advanced use of instruments. On the ground many learned skeet, some shooting a gun for the first time. Shooting the clay pigeons taught leading and basic deflection shooting, skills which would become second nature to them in the skies above Europe.

Next came aerobatic training and the final great washout of cadets. Their numbers now small and dedicated, the pilots learned

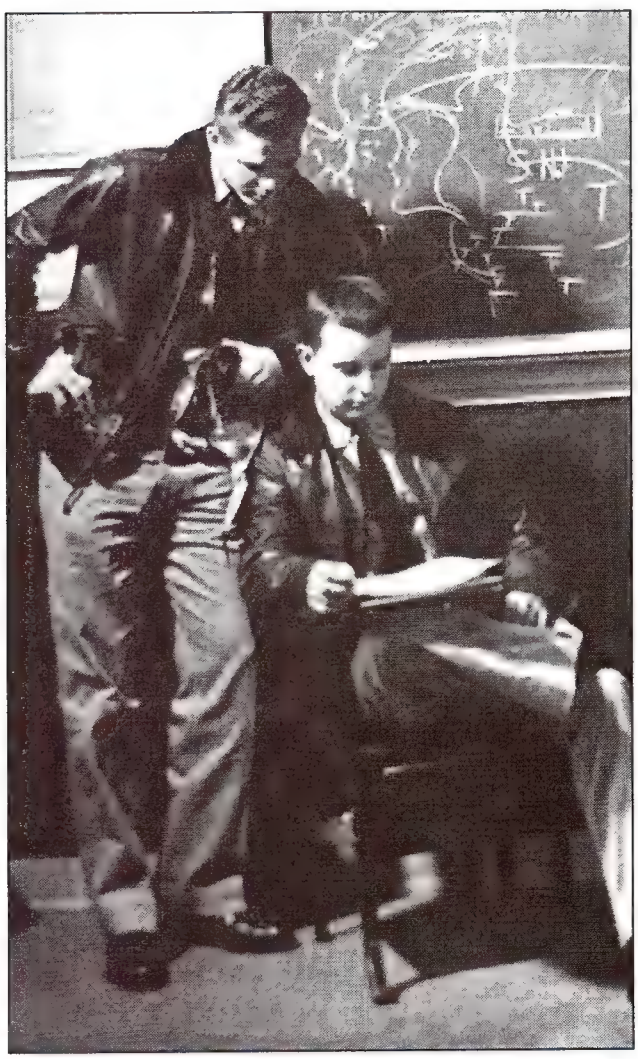


Photo 4-4

Flight cadets help each other bone up on their studies, going over notes after a course on aerial maneuvers.

Immelmanns, snap rolls, barrel rolls, and loops. Learning to fly in formation, the fiercely competitive cadets tried to fly as close together as possible with their wing tips often less than a foot apart.

Final training brought together all of the cadets' flight skills into simulations of the military missions they were likely to fly. Now they began flying actual fighter planes and practiced shooting against drone targets towed behind multiengine transports. Dive-bombing on land- and water-borne targets provided experience in holding the plane steady and in timing the drop and the pull-up for maximum accuracy.

The pilots also practiced night flying, the trainers fit with lead-acid batteries to power the red and green lights. Landing between a runway marked with flare pots filled with kerosene, the pilots practiced touch-and-go approaches into and with the wind.

Confidence Grows

By the time they had neared the end of training, the cadets had grown into young men. Sitting around their cots, playing poker for matchsticks (and for money when the duty sergeant wasn't around), they had an air of confidence about them—not a confidence colored with the foolish notions of the immortality of youth, but a confidence born of experience. The cadets had trained hard and long over the last 16 months or so, and flying was now second nature to them. They truly felt that when the moment came for them to be face to face with the enemy at

Photo 4-5

Service crews had to undergo intensive training also. Here they study propeller repair and balancing.

18,000 feet and the sun at their backs, they would know what to do. They would have the mettle to come through for their country.

Although in early training the war had seemed a million miles away, now it was only a few days or weeks away. They were ready. Some might crack under the pressure, but for most the exhaustive training truly had made fighter pilots out of a cadre of young dreamers.

Flight Dynamics 101—The Forces of Flight

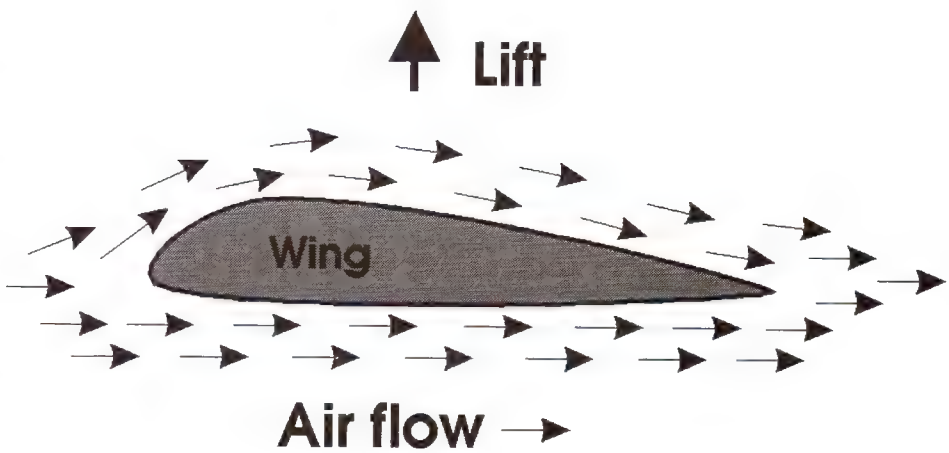
An airplane is a heavier-than-air craft, meaning that if there is no motion or thrust involved, it will sit still or fall. In order to fly, an airplane must move. To move, the airplane must generate thrust, which is provided by the engine and the propeller. A typical single-engine fighter will generate 1500 foot-pounds of thrust. Once an airplane has developed enough forward velocity due to forward thrust, it will begin to roll down the runway. At a certain speed, the wings begin to generate lift.

Lift

In most fighter planes, the wings are constructed utilizing an asymmetrical airfoil (see Figure 4-1). This causes the air that flows over the wing to travel a greater distance than the air that flows under the wing, in the same amount of time. Basically, increasing the speed of air thins it (or decreases its pressure). This discrepancy in air pressure from above and below the wing generates the force we call *lift* that, when strong enough, will lift the airplane into the air.

Figure 4-1

A cross section of an asymmetrical airfoil. The faster air moving over the sloped upper surface causes a decrease in pressure, generating the plane's lift.



The angle of attack of the airfoil also affects lift. The angle of attack is the angle with which the wing enters the airstream. Basically, a plane that is climbing has a higher angle of attack than a plane that is flying straight and level. To a point, a greater angle of attack will generate greater lift. Beyond a certain point, the wing becomes merely a paddle pushing awkwardly through the air and loses all lift entirely. This is known as a *stall*.

Drag

Another force acting on a flying aircraft is drag. Drag can be thought of as the opposite of thrust—or perhaps more accurately as a restriction of thrust. *Drag* is the resistance caused by an airplane as it moves through the air. While the wings are especially designed to create lift, the rest of the airplane creates drag.(The physical presence of the wing, however, also produces drag.) The more streamlined the airplane, the less its drag will interfere with the propeller's thrust. Such things as flaps, lowered landing gear, auxiliary fuel tanks, and heavy bomb loads all will contribute to distorting the clean form of the aircraft and increase drag.

Altitude Effects

The atmosphere is not an homogeneous entity; the density of air can vary for a number of reasons: humidity, temperature—and most importantly to the pilot, altitude. The atmosphere thins out as altitude increases. There are fewer atoms and molecules in each unit of air as the distance from the ground is increased. Since lift requires the physical presence of these atoms and molecules, lift decreases as the atmosphere thins. Depending on the shape and size of the wing (as well as the mass of the airplane itself, including all extra fuel and munitions), there is a point at which the plane no longer can generate lift. The force of gravity is stronger than the force of lift. This is known as the *ceiling of the plane*, and it is physically impossible to fly higher than the ceiling (other than letting momentum carry the plane above the ceiling for a brief moment).

The thickness of the atmosphere also has an effect on the plane's propeller. Since the propeller itself is a type of high angle-of-attack airfoil moving through the air, it must battle with drag factors of its own. As the altitude increases, and the atmosphere thins, the drag on the propeller diminishes. Therefore, there is a

certain altitude range in which it can move as freely as possible, generating optimal thrust, and still operate at a low enough altitude so that the wings generate sufficient lift.

Also, it may be obvious by now that as the wing's ability to generate lift decreases with altitude, so does the functionality of the plane's various control surfaces. At high altitudes, some planes perform very sluggishly.

G-Force

The central force which acts on a terrestrial body in motion is gravity. For an airplane, which is moving and generating inertia and forces of its own, another force comes into play: *G*-force. A *G* is a shorthand term for gravity, and basically 1 *G* is equal to the force of gravity of an object at rest on Earth. While *G*-forces certainly affect the mechanical aspect of a plane and its performance, the most crucial element of the plane affected by the force is the pilot.

As a plane banks tightly or performs a loop, it generates incredible centripetal force. That force acts in much the same way as gravity, but it is a force directed perpendicularly to the movement of the plane. In a tight, knife-edge, break turn (see page 64), the *G*-forces are acting against the pilot, pressing him down into his parachute. In a steep dive, the pilot is pressed back against the seat, the force pushing against his chest.

A force of 4 *G*s is equal to 4 times Earth's gravity, essentially meaning that the pilot's weight, from a functional point of view, has increased fourfold. A typical mono-wing fighter was capable of generating *G*-forces in excess of 7*G*s. These forces are an incredible strain on the pilot, making it hard to hold his head upright, to move the control stick, and to breathe comfortably. More importantly, *G*-forces act on the blood in the pilot's body, pulling it away from or pushing it into the pilot's brain, in the direction of the force. If a pilot has too little blood in his brain, he risks blacking out; too much blood, as in a steep dive, and he may experience a red-out.

Compressibility

When planes are flying at very high speeds—particularly in a long, steep dive—it is possible that the air flowing over the wing will exceed the speed of sound. (Remember, the shape of the

wing makes the air flowing over the airfoil travel faster than the airplane itself.) When this happens, the pilot will not hear a sonic boom since the plane is still traveling slower than the sound barrier; however, the air itself will create a shock wave that will ripple through the air flowing over the wing, particularly at the trailing edge where the control surfaces are.

This phenomenon is known as *compressibility*, and it makes control surfaces worthless. The pilot cannot control the plane as it plummets towards the Earth. Planes such as the P-38 Lightning are particularly susceptible to this problem, mainly because of their large wing surface and the triple fuselage that distorts and echoes the shock waves. When an aircraft is experiencing compressibility problems, the pilot must not panic. The most important thing is to slow the plane down. Lowering flaps and landing gear and cutting back the throttle all will help to slow the plane down. When the airflow falls below the speed of sound, the pilot will regain control.

The Basics of Flight

An airplane is a slave to the above-mentioned forces, but the dynamics of atmosphere and lift allow the pilot an impressive amount of control. It is amazing to think of a 6-ton machine made of metal and wire evolving into a nimble facsimile of a bird, swooping down through the clouds. To fly, though, the plane first must leave the ground.

Taking Off

While at rest on a runway, a fighter plane has all the lift of a tin of K rations, but it does have the potential for flight. First, the throttle must be increased to provide the necessary thrust. A pilot may then lower the flaps to increase the lift-generating ability of the wing's airfoil. As the plane begins rolling down the runway, it will generate enough speed to surpass the stall speed. (For the stall speed of the planes you can fly in *Aces Over Europe*, turn to Chapter 6).

Once the plane is traveling fast enough, the pilot pulls back on the stick to allow the elevators to guide the airplane into the air. If he pulls too far, the angle of attack will be too great for the wings to generate lift. If he doesn't pull back enough, the plane will run out of runway.

Figure 4-2

The ailerons control a plane's bank and are the central control used for turning.

The Plane in Flight

Once in the air, the airplane becomes an object moving in restricted, three-dimensional space. I use the term *restricted* because flying an airplane is not at all like flying a spacecraft in a vacuum. An airplane is still very much a slave to gravity and the essential two-dimensional rules of a terrestrial body such as Earth. If you cut the engine of a spacecraft, it will fly forever in a straight line; cut the engine in a P-47 Thunderbolt, and it will fall like a very expensive rock.

Bank

In the air, a pilot controls movement around the three axes: bank, pitch, and yaw. The movements of the plane are made in relation to the ground and the forces of gravity. The *bank* is basically the rolling of the airplane's wings left or right and is controlled by the ailerons, which are small flaps on the rear edge of each wing. Moving the stick left causes the left aileron to dip and the right aileron to rise. The ensuing change in the shape of the plane's airfoil then causes the plane to bank left and enter a gentle turn. If you move the stick the other direction, the plane will bank right.

Pitch

Pitch relates to the movement in which the nose of the plane points either above or below the horizon; in other words, pitch controls diving and climbing. The elevators—the control surfaces at the rear of the tail airfoil—control the pitch. Moving in tandem (as opposed to ailerons, which move in opposite directions), the elevators push the nose of the plane either down or up. Pulling back on the stick raises the elevators and causes the plane to climb; pushing forward causes the plane to dive.

The throttle also can have an effect on pitch, allowing the plane enough forward velocity to pitch up at a greater angle without

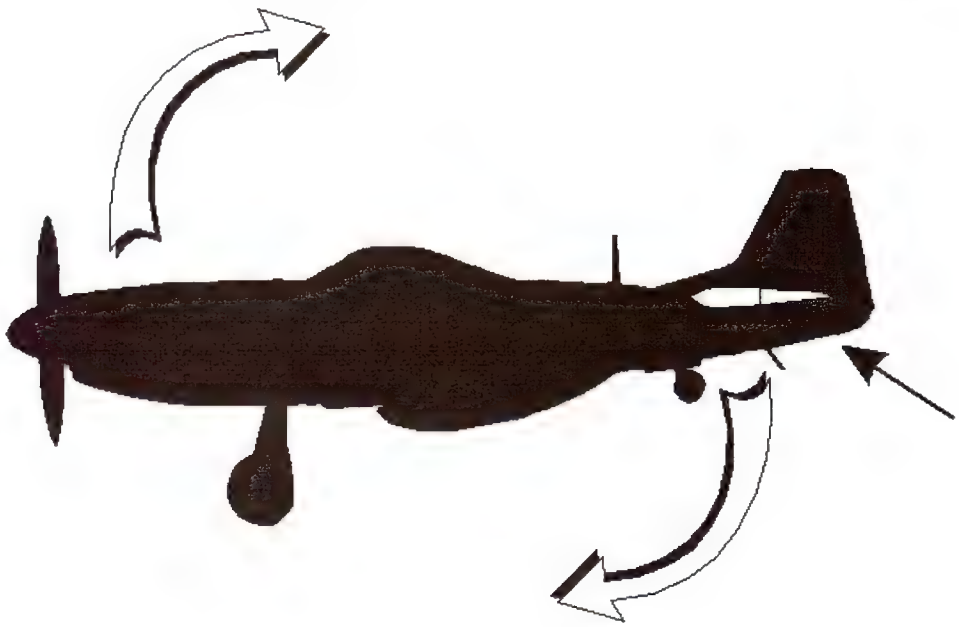


Figure 4-3

The elevators control the pitch of a plane and whether it is climbing or diving.

stalling. Conversely, if you are flying straight and level, cutting back on the throttle will slowly reduce the plane's altitude without affecting the pitch too greatly.

Yaw

Yaw is the left–right twist of the airplane, as if moving on a central spindle. It is somewhat—but not entirely—independent of the direction in which the plane is moving. The rudder, which

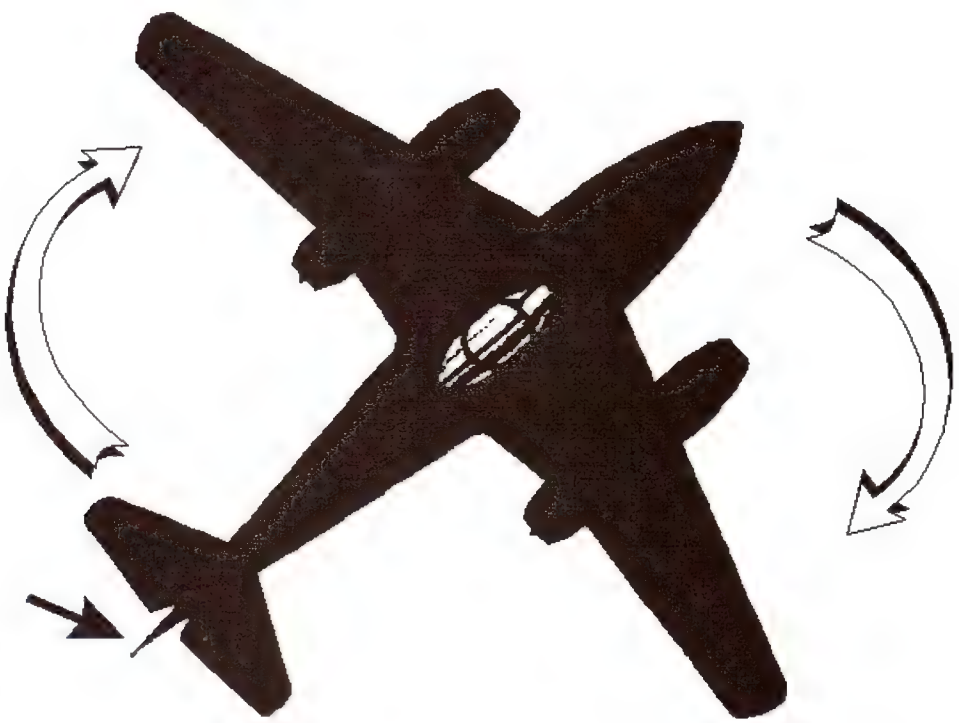


Figure 4-4

Located in the tail, the rudder controls the yaw of the plane.

is the vertical control surface on the tail of the airplane, controls a plane's yaw. In flight, utilizing rudders and ailerons together can give greater control over a turn. Used alone, rudder adjustments can be used for accurate aiming or for lining up with the runway at landing.

Basic Flight Maneuvers in Aces Over Europe

Aces Over Europe allows you, through the training missions, an opportunity to fly with no enemy threats and no risk to yourself (other than crashing the airplane). Since none of the training missions feature opposition that will fight back (the one exception being the Intercept training mission, in which the bombers will pepper you with defensive fire), they will all do for basic flight training. You might want to load up the Landing training mission. That way, you can practice your maneuvers around a friendly airbase, much as the cadets did in their flight training.

FLY SINGLE MISSION: TRAINING MISSION: U.S. ARMY AIR FORCE: LANDING

You will begin the mission flying a P-38 Lightning, heading for the runway. Your altitude is 2000 feet. Throttle up to 80 percent and gain some altitude before going over the maneuvers below. Switch to the External view to get a lay of the land. You will see the airfield with a road and several bridges in the distance.

Break Turn

In the previous missions, you flew utilizing only one of the basic toolbox maneuvers, the break turn. A *break* is a tightly banked turn (sometimes tight enough to cause sufficient *G*-forces to cause a pilot to black out) that is made with the assistance of the elevators. Your wings are no longer parallel to the ground when you turn your plane into a tight bank, and the ailerons lose much of their ability to function as turning controls. Just banking tightly with no elevators applied will result in a fairly tight falling turn (meaning that you will lose some altitude). In this type of turn, using your rudder effectively can keep your altitude stable.

In a tightly banked turn, you can increase the rate of turn by using your elevators. Normally the elevators are the surfaces which control your change in altitude; however, since you have changed your relationship to the ground (and to the air flowing over the surface of your plane), the elevators now function differently.

Figure 4-5

A break turn seen from a bird's-eye view

By pulling back on your stick you increase your rate of turn to the maximum. Pushing forward will slow your turn. You can also experiment with using the rudders to keep your altitude stable, or you can apply opposite rudder to make your turn even tighter; however, you will lose considerably more altitude.

By utilizing a break you often can get out from under an enemy's gunfire. Linking together several opposite-breaking turns will produce a *chicane* (called a *scissors*) that will make you a more difficult target to hit. Remember, though, that you will want to make your breaks irregular or an enemy will just wait and fire at you as you cross across his targeting sweet spot.

Take a few moments now to practice breaking turns. Try first at 80 percent throttle and then at 100 percent (remember to heed your engine temperature light.) Keep your eyes on the compass and the altimeter as you try different combinations of ailerons (left–right movements of the stick), elevators (forward–back movements of the stick) and rudders ([[ ] and [ ]] keys or rudder pedals). Notice how the three variables interact. If you are flying with the Realism settings at their highest level, you will probably notice turns so tight that the screen will start to fade to black. This means that you are generating sufficient *G*-forces to

push the blood from your brain. If you do black out, let go of the stick; in a few seconds, you should revive (unless you were flying low enough to cut your career short with a crash).

Roll

To practice a roll, climb to several thousand feet of altitude. A *barrel roll* is essentially a corkscrew maneuver, leaving you at the same altitude and heading as before. In combat, it is a useful evasive maneuver when a bandit is on your tail.

Fly straight and level and push your stick to the left, pulling back slightly to apply some elevators to keep your roll on a straight line. Keep your stick full left as you roll to inverted flying; ease off the elevators and keep the stick steady, finishing up the roll when you come back level with the horizon.

Practice a roll several times, experimenting with when to lean on and when to hold back on the elevators. With proper timing and a little practice (and enough airspeed), you can perform a roll with no loss in altitude.

Try a right barrel roll several times until you get the rhythm down. The movement is fluid, especially when easing out of the roll. You don't want to overreact. That's a sure sign of an amateur pilot. Take it slow and steady, and relax.

Immelmann

The Immelmann (named after Max Immelmann, a WWI ace) is a maneuver consisting of a half loop and a half roll. Given enough speed and power, it is a relatively easy maneuver to conquer.

Begin with straight and level flight and full throttle. Pull back on the stick, giving full elevators, and your plane will begin to climb. Hold steady, and the plane will loop over to inverted position, several hundred feet above your starting attitude. Let

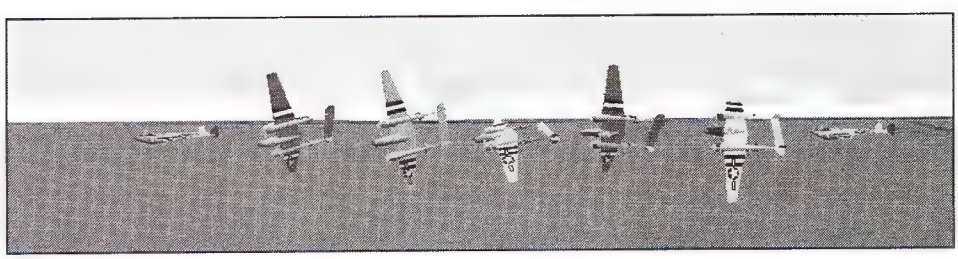


Figure 4-6

A properly executed roll seen from the side

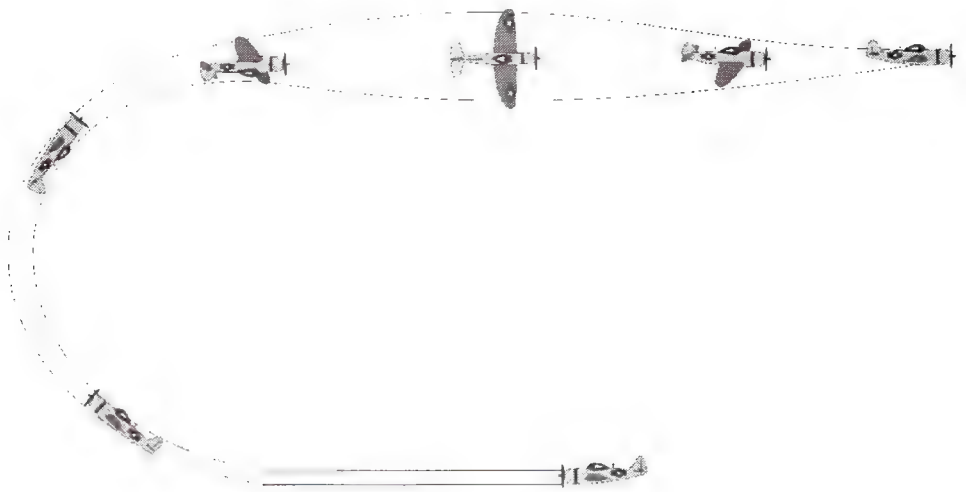


Figure 4-7

An Immelmann seen from the side

up on the elevators and push the stick easily left or right to roll the plane over to a level position.

The Immelmann will cut quite a bit of speed off your plane, so experiment with different throttle settings, noting when the speed is not sufficient to carry you over the top. You are most vulnerable in an Immelmann just as you are reaching the top of your loop and are still inverted. Your speed is the slowest, and your vantage point and offensive position are poor. Beware of this before attempting an Immelmann in a close-proximity dogfight.

A Split-S, the Immelmann's high-speed cousin, is another good aerobatic skill. Read about the Split-S in Chapter 8.

Loop

Begin with straight and level flight and pull back on the stick. The loop puts quite a lot of varying stresses on your airplane, so remember that your speed will diminish as you reach the top of the loop when you will be flying inverted. Keep back pressure on the stick to follow through the loop, noting the increase in speed as your plane falls; then pull back to straight and level flight.

If you perform a loop properly, you will maintain the same compass heading you had when you started, but you will lose some altitude and gain a slight amount of speed.

The outside loop, begun from a dive and pushing forward on the stick, is a maneuver that puts incredible stresses on a plane's airframe. Often the stress is too great, and the plane either will suffer compressibility problems (when the elevators or ailerons

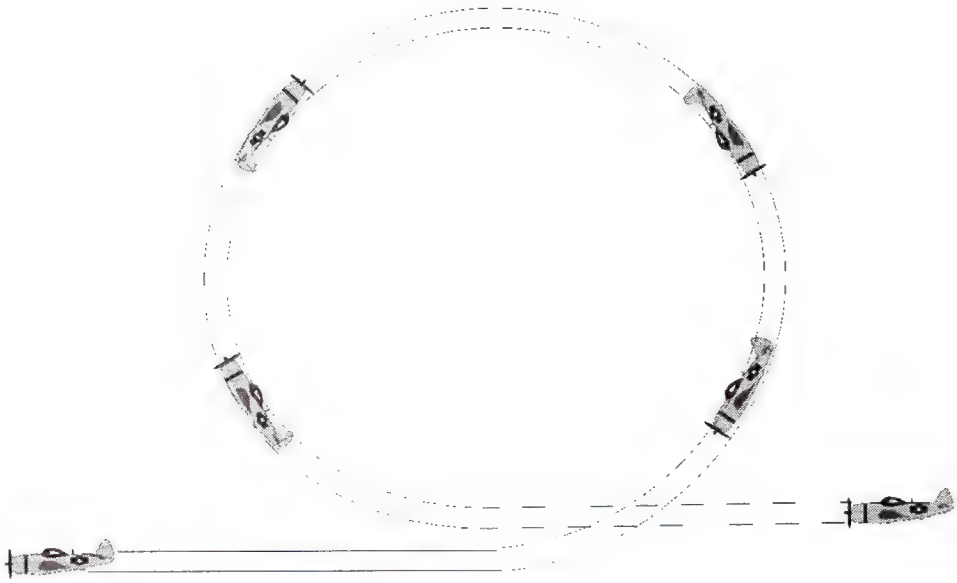


Figure 4-8

An inside loop

lock in place), or the airframe itself will take damage. Try an outside loop (remember to gain plenty of altitude), keeping forward pressure on the stick to get a feel for this dangerous—and not recommended—maneuver.

Recovering from a Stall

A *stall* occurs when the airplane does not move through the air with sufficient speed to generate enough lift to counteract the weight of the plane. This may occur if you cut your throttle and fly straight and level until the speed is too low. Attempting to fly at too great an angle of attack—such as pulling up at takeoff too rapidly—also will cause your plane to stall. Stalling at low altitude is a ticket for disaster since there will not be time to recover before crashing.

When your aircraft stalls, you need to generate more speed; therefore, nose the plane down and increase throttle. Do not attempt to force the nose of the plane up during a stall because you will lose more airspeed. When sufficient speed is achieved, your plane will begin to fly again.

Recovering from a Spin

A *spin* is a complex form of stall when one wing stalls before the other, generally occurring during a tightly banked maneuver at an airspeed too low. One wing will stall and cease to generate lift, while the other wing—still producing lift for the moment—will drive the plane into a corkscrew descent. As the plane falls,

it will pick up speed; however, the outer wing will continue to have a greater velocity than the inner wing, making the spin continue and even accelerate.

If the spin is not too fast, it can be stopped by centering the stick and applying full rudder in the opposite direction of the spin. Applying down pressure on the stick also will help the plane into a controlled dive rather than a spin. Hold the controls until the plane begins to slow and finally stops the corkscrew, then gently pull back on the stick to return to level flight.

If a spin is too great, the only option may be to bail out. The possibility exists, however, that the spin will cause sufficient *G*-forces for you to black out or to prevent your escape. When the plane is spinning and falling rapidly, the small surface area of the rudder may be inadequate to overcome the inertia of the larger wings. Because of this, it is imperative to break a spin as soon as possible, and if it is not possible, bail out immediately (Ctrl-B).

Landing

When you first try to land, it would be wise to reload the Landing training mission in order to give youself a clean approach to the runway. Remember, tap the Esc key to exit and replay the mission.

You begin your approach from 2000 feet with an airspeed of 200 mph. Immediately throttle down to 70 percent and lower your flaps fully (the F key tapped twice). Use your rudder gently to line up with the runway. The primary key to any successful landing is control. You don't want to overcompensate and careen over and into the runway. In later career missions, you will need to land in order to end the mission (especially if you received any battle damage), and you don't want to cut your successful career short. Eventually, landing will become intuitive enough to allow you to swoop down to the runway like a pro; for the near future, line up straight and level from some distance out, adjust your aim with your rudders, and leave the ailerons alone. This will be an elevator-and-rudder mission.

Lowering your flaps will cause panels just inside the ailerons to fold down, essentially increasing the lift potential of your wings and increasing the drag. With the flaps fully lowered, your stall speed will decrease to about 85 mph.

The object of a perfect landing is to stall your airplane at the instant it touches the runway (or a few inches above). This can

be a tricky exercise in timing. The exact stall speeds vary slightly from plane to plane, so practice until your second sense takes over.

If you fly the plane into the ground, you run the risk of skipping your plane—essentially bouncing it off the runway. In that moment of panic, it is very easy to overcompensate and crash the plane. If you stall too high, your plane most likely will crash. It probably won't be a fatal crash, but you certainly won't earn any bragging rights at the officers' club.

Point your nose down to the runway for a gentle approach. You'll have to keep some pressure on the stick because the increased lift of the flaps will want to make your plane climb. At 1400 feet, cut your throttle down to 60 percent. Your airspeed will still remain around 200 mph. At 1000 feet cut throttle to 40 percent, striving for an airspeed of 150 mph. At 800 feet, cut to about 25 percent throttle, lower your landing gear (which will increase the plane's drag and slow it down even more). Your speed should be between 90 and 100 mph.

When you start getting low (when the little grid dots start appearing on the ground), pull your nose up slightly. Since the P-38 has tricycle landing gear, you don't want to fly the nose wheel into the ground. As low as you possibly can, pull the nose up even farther, almost level with the horizon. If you've timed everything correctly, you should see the stall warning flash on screen just a second or two before you touch down. When you

Figure 4-9

Just a foot above the runway, the P-38 stalls and floats to the ground like a feather. Perfect landing!

land, cut the throttle completely and apply the wheel brakes (W key). You shouldn't need them because a perfect landing will generate very little residual forward velocity.

If your first landing was a total wash, replay the mission. If you were close but didn't quite get it, select Save Mission To Tape and enter the Mission Recorder to view your mistakes (for detailed instructions on the use of the Mission Recorder, turn to Appendix A). You can switch to External view to watch your approach or keep the view on the instruments to gauge what went wrong. If you were just a hair off, advance the tape to the point just before the mistake and select Enter Sim to replay the last few moments of your landing.

Good job! You can now take off, fly, and land a high-performance fighter plane. The bogies are waiting, but still there are many hours of practice left before you truly can earn your wings.

From the Journal of Lloyd "Buster" Stinson

Aviation Cadet, USAAF, Maxwell Field, Alabama;
January 4, 1944

Today brought with it the second straight week of winter weather. Before my flight today, I put on an extra pair of socks. It made my feet hurt in my boots, but it was a warm hurt.

I had my sixth flight in a P-47 this morning. The plane seems to growl, almost like the tigers in the zoo back home. It feels like the plane doesn't want to be here for training; it's like it wants to be over there, going after Krauts. The baby sure hums compared to those Stearmans we flew back in prelim.

I went up solo today for my second dive-bombing mission. A band played on the flight line as we all mustered and gathered by our planes. Even in the cold air, watching my breath, it got my heart racing. I guess that's why they do it.

Monday was an off day for me. The clouds were thick as cream, and my bomb missed the mark by 60 yards. They know I'm a good pilot, though, and you get a few misses before they mark you with a demerit.

Even though it was cold this morning, the sky was clear for miles. After I got called for my run and took off, it felt like the entire world was asleep. Looking down, I saw nothing moving. Even the squadron of cadets I flew over seemed frozen on the tarmac. I guess in a P-47, things are just moving so fast that everything else stands still.

Four of us went up together, but we didn't fly in formation. I'm up second for the bomb run, so I flew over Hazard's Field to practice rolls. Getting just the right elevator is tricky because you have to shift from up to down elevator just at the right moment. I almost have the hang of it, but not yet.

When my call came over the radio, I pulled right and headed for Parson's Pond. Not a pond really, but a lake. Years ago it was just a pond in a kettle of earth, but they rerouted some of the reservoir's overflow to create a lake. Anchored dead center are four tankers, all rusty and twisted, but they make good dead-duck targets.

They looked like ghosts as I approached, not reflecting the sun at all. It reminded me of the set of Taming of the Shrew I saw two years ago in Peoria—one of those modern interpretations with scrap metal making up the walls of Petruchio's villa.

I lined up my run on the first tanker with just my rudders, keeping my altitude at 500 feet just like in the training film. As soon as the tanker dipped below the cowl, I pulled down into a shallow dive, throttling back because I wanted this one to count. At 200 feet, just as the hull slipped past my view, I released the load.

Halfers, they call 'em—bombs loaded only half full. That way, the targets will last longer and if some turkey lets his fly too low, the Army won't be out a P-47 from the blast.

I pulled up gently, twisting around when I heard the reassuring whomp of a dead-on impact—a clean hit; but as I circled back to base, I could see that it was a little too sternward to sink the ship if this had been an actual run. I'll have to do better next time.

I wagged my wings at the judging pylon on the shore as I headed in. Even an off-center hit is still a hit. Through the smoke, they might not be able to tell.

FLY SINGLE MISSION: TRAINING MISSION: U.S. ARMY AIR FORCE: ANTI-SHIPPING

You will begin the mission flying a P-47D Thunderbolt, starting out at 500 feet of altitude with an airspeed of 300 mph. The journal entry above should give you a good feel for the mission. The most important thing to remember is to lead your target since the bomb won't fall straight down when you release it. Also, don't get below 200 feet when you release your bomb because if it hits, the explosion will take out your plane as well.

After trying a bomb run (you are carrying only one bomb), pull up, gain some altitude, select Full Guns, and turn back for a strafing run. You can get much lower with your guns blazing, but don't get so low that you can't pull up. Guns are much less effective than a properly placed bomb, so it will take a number of hits to take out the tankers.

In the heat of a real battle, you probably won't have the luxury of doing more than one strafing run (as you turn back to return home), so practice your targeting to make that one run count.

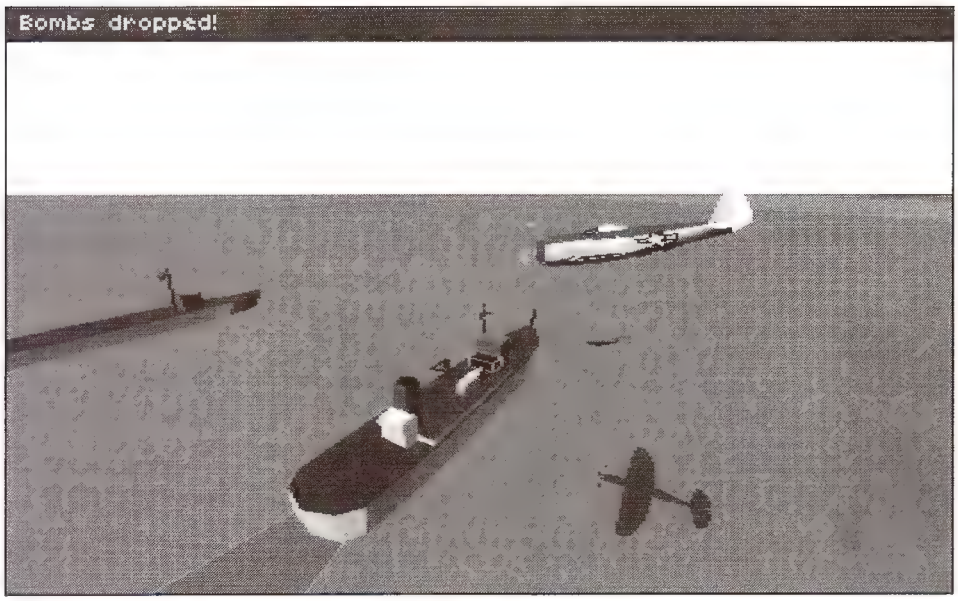


Figure 4-10

Bombs away! The bomb is on its way to a direct stern hit.

FLY SINGLE MISSION: TRAINING MISSION: ROYAL AIR FORCE: GROUND ATTACK

One of the most vital services the fighter pilots provided was an ability to strike at ground targets, specifically at convoys carrying troops or munitions. Because of an airplane's ability to enter and leave a situation quickly, air strikes against convoys were far more practical than infantry or armor strikes and much more accurate than artillery strikes.

In the weeks before D-Day, the Allied air forces paid special attention to convoys of German trucks, half-tracks, and tanks. Disrupting the logistical flow of the German ground forces proved to be a very vital tool in ensuring the best odds for the massive beachhead landing.

Trains were also a prime target since they could carry massive artillery weapons or tons of munitions and hundreds of troops. By destroying a train's engine, they effectively blocked the track until a service crew could be dispatched to remove the locomotive and repair the track.

The Allied destruction of the French rail lines was a key factor in Germany loosening its grip on France.

You will begin this mission flying a Typhoon, armed with four 20-mm cannons. The Typhoon was the RAF's principal ground-attack fighter because of the cannon armament. Several

well-placed shots, and the Typhoon could take out even the heavily armored German Tiger tank.

Dead ahead, on the road, are four tanks traveling as a small convoy. Lower your throttle to 60 percent or 70 percent and pick out the lead tank. You will want to fly low but not too low because the Typhoon is notoriously unresponsive when you need to pull up sharply. Aiming for the lead tank is a good choice because if you can take that tank out, you will have effectively stopped the convoy, making the other vehicles easier targets.

Nose down slightly, select Full Guns, and lay into the first tank. It will take three to four direct hits to destroy the tank. After destroying the tank, pull up, increase your throttle, and climb to at least 500 feet (you will need the altitude to make the turn). Fly straight for 15 to 20 seconds, break left or right, and line up for another pass.

If you are flying an actual mission, you may or may not have to contend with enemy fighters. If the skies are clear, take as many passes as you can from the side (you have the longest targeting time from the side approach). If you must evade fighters, it is a good strategy to line up your run along the roadway. Your targets will flash by much quicker, but with careful aiming, you can take out several vehicles in a single pass.

FLY SINGLE MISSION: TRAINING MISSION: LUFTWAFFE: INTERCEPT

The Intercept training mission is perhaps the most difficult since you will be only a single plane battling a formation of bombers,

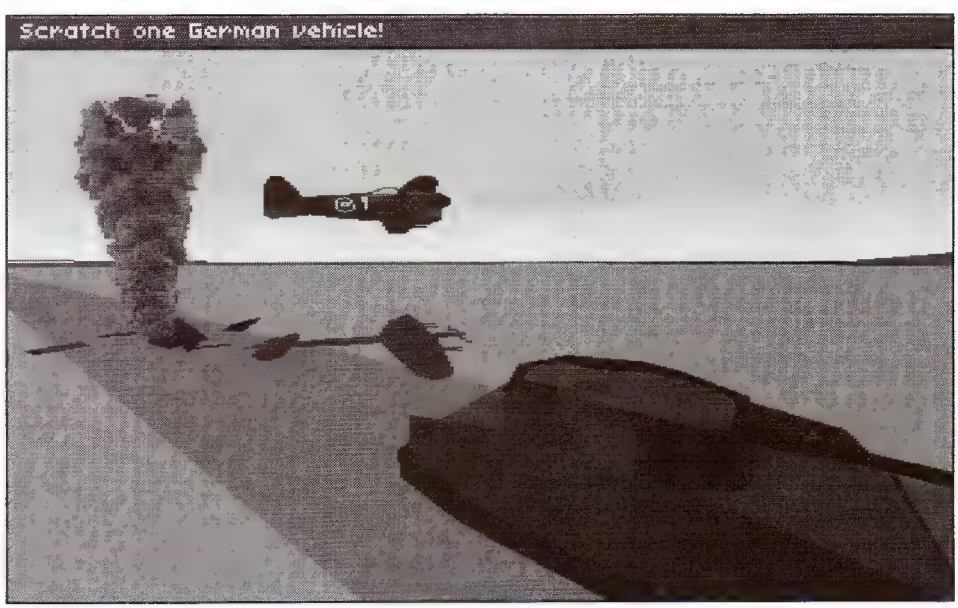


Figure 4-11

A Typhoon takes out a panzer with 20-mm cannon fire at 40 feet.

all of whom will fire at you. This is also the most important mission from a tactical, training sense since intercepting and taking out bombers was the most important role for the Luftwaffe in the later war years.

By 1944, the Luftwaffe had lost air superiority, and it had switched from an offensive strategy to a reactionary defensive strategy. Although this training mission will make use of all the basic maneuvers covered in this chapter, as you work through the book and your own hours of practice, you may want to return to this mission again and again.

You will be flying a Focke-Wulf 190D, at an altitude of angels 21 (21,000 feet), with an airspeed of 350 mph. As the mission begins, the bomber wing is 300 feet below you and closing fast. You might want to switch to Exterior view, pan to get a good sense of the area, and pause the simulation.

There are six Martin B-26 bombers in the flight. Four are flying as a group, with two more in the rear perhaps 300 feet below. This formation will allow the bombers to trap a fighter between the two groups and pepper him with fire from both the front and the rear.

Your initial strategy should be to attempt a face-on run. Switch to Full Guns, 80 percent throttle, nose down, and head for the formation, guns blazing. The bombers will begin to fire at you; however, since your closing rate is well over 500 mph, they will have a hard time hitting you. When firing on a bomber, you want to keep your plane relatively stable and attempt to get all hits in the same area. A face-on attack against a bomber will give you the highest probability of scoring a critical hit and taking out one of the "big birds."

Your goal in this mission, at least for the first pass, is to take out one of the bombers. Practice until you can do this with relative consistency.

After you fly past the first wing, pull down even more and go for one of the two stragglers. Don't let yourself get fooled into turning and following the lead group. The two bombers in the rear will most likely down your plane with defensive fire.

As you fly through the formation, you will begin to get a sense of the impossible odds the Luftwaffe pilots had to face later in the war. Theirs was a battle of desperation, and this mission brings that feeling alive. You will also experience the danger of

bomber fire. The rear half of the B-26 features a turreted gun just fore of the rudder, a tail gun, and two underbelly guns. These are maneu-verable weapons that will follow you through the sky. The B-26 was a very awkward plane in which to perform evasive maneuvers, but the armament more than made up for its poor flight performance. To avoid being downed, keep your plane swerving in unpredictable breaks as you close in and maneuver. To fire effectively, though, you will need to keep your FW steady, so keep your fire bursts short and on target, swerving away to make another pass.

It will take excellent flying skills and quite a bit of luck to take down all six bombers. A good goal is to shoot for four. Had this been an actual mission, after shooting four, it would not be time to test the Fates but time to turn tail and head for base. A pilot who lives to fight again is a very valuable commodity indeed. This is doubly true when flying for the Luftwaffe.

It is a good idea to save the Intercept mission to tape in the Mission Recorder. Study the way in which the bombers use their defensive fire. You will discover some less protected areas, such as a high-angle dive attack. Even more vulnerable if you can manage it is a high angle-of-attack climbing attack, aiming at the nose and the underbelly beneath the wings. If you attempt this strategy, remember to break before you enter the range of the rear machine guns.

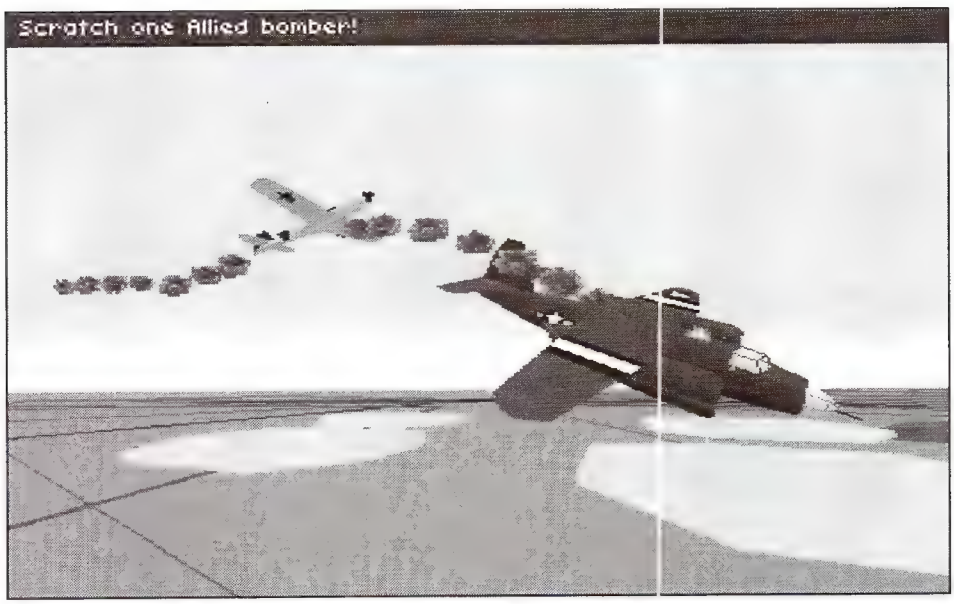


Figure 4-12

A Focke-Wulf 190D takes down a B-26 Marauder at 20,000 feet.

This chapter has introduced you to the basic flight and combat maneuvers, as well as the introductory training missions (You already practiced Aerial Gunnery in Chapter 2). These maneuvers should be sufficient to get a feel for some of the Historical Missions. Go ahead and try them, or enlist in a career if you feel adventurous.

More advanced maneuvers and combat tactics will be covered in Chapter 8. Feel free to look ahead if you can't wait.

Luftwaffe Pilots

Throughout the prewar and early war years, the pilots of the Luftwaffe underwent training very similar to that of the Allies; in fact, they were required to fly many more hours in training than the Allied pilots.

This careful, detail-oriented approach to training fell to the wayside in the last 16 months of the war. The Luftwaffe pilots were being killed off at an alarming rate. Some pilots in the field had hundreds of missions under their belts, but their dwindling numbers could not fill the increasing gap. Germany needed more pilots.

In an effort to gain the needed numbers, the Luftwaffe began to recruit from the ranks of the many youth organizations in the Third Reich. These groups, often lumped together under the term the Hitler Youth, were young boys in their mid to late teens who participated in activities much like the Boy Scouts in America. The key differences, however, were the military slant of their training, the indoctrination into Hitler's philosophy, and the idea of an Aryan empire ruling over Europe.

Often fanatically dedicated, these boys were eager to jump behind the stick of a Focke-Wulf and take to the air. Many youth camps became ad hoc flight training centers, with the aim of turning out thousands of dedicated pilots in a very short time.

While their dedication may not have been in question, the boys were often too immature truly to understand Hitler's philosophy and too excited to glean all that was needed from their accelerated course of training. There can be no substitute for experience, for flight time, and for the luxury of being able to learn from their mistakes. The new generation of pilots had none of these luxuries.

When these young pilots were assigned to combat flight groups, they first realized the incredible odds they were up against. Often the young pilots were overwhelmed in the sky, freezing up or unable to perform against the consistently trained Allied pilots.

As a result, in the last months of the air war, the veteran pilots still carried the lion's share of the combat burdens and racked up mission counts well over 300. One by one, the odds were against the veteran pilots and their young companions, and combat took its toll. Week by week, the central core of successful fighter pilots dropped in number.

In an effort to play catch-up and to fill the gap created by years of attrition, the Luftwaffe slit its own wrists by accelerating the flight training. Of all of the myriad of tasks for the military personnel during the war, none required more hours of training and practice than the important role of fighter pilot. Rushing cadets through training would cost the Luftwaffe dearly.

Duty Orders

At the end of long months of training, the Allied pilots felt they were ready to see action. Although they would be rookies when they reached their station in Europe, at their training bases they were the top dogs—the ones with real experience.

Near the end of the war, the wait for duty orders was not a very long one. Still, the pilots often had to wait a week or two for their assignments. Those days were spent accumulating flying hours, playing poker, and lecturing to young cadets. Whenever possible, the Army Air Force would attempt to assign several cadets as a group since they knew each other's little quirks and eccentricities. This made for a cleaner fit into an existing flight unit because squadron commanders wouldn't have to spend so much time monitoring the rookie pilots—they could back up each other. In practice, however, the complexities of assigning hundreds of new pilots each week to fighter squadrons led to a more haphazard distribution than would have been hoped for.

When the orders came to ship out, the pilots packed their duty lockers into their duffels, oiled their flight jackets, and set sail for Fortress Europe to begin their careers as combat fighter pilots. We'll learn more about their battles in our upcoming chapters, starting in Chapter 5 with the Battle of Britain.

The Battle of Britain and Beyond

However absorbed a commander may be in the elaboration of his own thoughts, it is sometimes necessary to take the enemy into account.

Winston Churchill

As the Germans marched over the beach at Dunkirk, they felt Europe was theirs. They had conquered Poland, France, Belgium, and Holland. Spain and Italy were allies and Russia felt comfortable—for the moment at least—that Hitler would keep his word not to invade. They had sent the entire British Expeditionary Force running back to their lone island ripe for siege.

Goering was exuberant at the decisiveness his Luftwaffe had shown and confident about the Reich's abilities in battle. Then Erhard Milch, the inspector general of the Luftwaffe, reminded him that while they had succeeded in cornering the British and French, the enemy in turn had succeeded in evacuating nearly their entire force off the beaches at Dunkirk—225,000 British and 114,000 French.

The Battle

To take advantage of the current situation, the Luftwaffe had to develop a plan to attack Britain immediately. On June 6, 1940, Goering outlined his invasion plan to Hitler, stressing the immediacy of the action. Hitler considered Goering's advice but ordered him to do nothing. Hitler was still convinced that he could use diplomacy to win over Britain, and he still admired the Empire and did not want to "rub their nose in defeat."

Throughout the Battle of Britain, Hitler was less interested in the attack than many believed. Mentally he was focusing his energies on planning the attack of Russia. Although in the previous campaigns Hitler had been involved in the most minute strategy details, he was much more removed from the planning when it came to Britain. He knew that Britain alone could not drum up the forces to execute an invasion of Western Europe, already in Germany's hands.

After passing on Goering's plan for an invasion, he offered his own—Operation Sea Lion. The plan grew out of Hitler's frustration over Britain's reluctance to acquiesce to Germany's plans. Ironically, at the outset of the war Hitler had seen Britain as a potential ally, and as both Britain and Germany were gearing up for a possible conflict, Winston Churchill had not seemed entirely deaf to the fact that a diplomatic agreement could be made.

In actuality, however, Churchill was buying time as he strengthened the home guard and set the factories operating around the clock to produce fighter aircraft. The women and children were sent into the country in anticipation of the dark days ahead.

After Germany had occupied the channel islands and countless appeals to "reason" had failed, Hitler saw no choice but to initiate conflict. In a speech at the Kroll Opera House in Berlin, Hitler barked, "Mr. Churchill ought perhaps for once to believe me when I prophesy that a great empire will be destroyed, an empire which it was never my intention to destroy or even harm."

Operation Sea Lion consisted of an initial phase spearheaded by Goering's Luftwaffe to gain complete air superiority over the RAF in British skies. This would be followed by a land invasion of a quarter million German troops on England's southern beaches. From there they would head north and surround London, effectively cutting it off from the rest of the country.

Winston Leonard Spencer Churchill, flamboyant statesman, egoist, and self-proclaimed megalomaniac was called to serve as Britain's prime minister on May 10, 1940. Churchill, who was often seen by the British public and the royal family as a warmonger, named himself the Minister of Defense and was careful not to clearly define his duties and powers. He even went so far as to send a member of the royal family—the Duke of Windsor—across the Atlantic as the governor of the Bahamas. It was not until the Battle of Britain was over that Churchill enjoyed the wholehearted support of his people.

In retrospect, however, it was this steadfast determination and military intellect that kept Britain on the right course in its defense of Europe against the Luftwaffe. Expecting an assault from the Luftwaffe, the British had done their best to prepare. In the years before the war, they had developed a rudimentary radar signaling system that allowed them to detect the presence of German planes. This Radar Direction Finding (RDF) together with the Observer Corps—men and women who continually scanned the coastline for incoming fighters—afforded Britain a sophisticated early-warning system.

First successfully tested in 1935, RDF was tuned to differentiate between RAF and German aircraft. This system was linked by a communication system that had been set up initially in 1918 at the end of the First World War. The RDF, even though very primitive compared to today's technology, was able to not only detect incoming aircraft but also give location and speed information.

In the RAF plotting room at Bentley Priory, all of Britain's early detection systems came together. In the center of the room, a giant chart of southern England was updated constantly by members of the Women's Auxiliary Air Force, who placed and moved symbols across the map as information was relayed to them. The moment planes took off from Germany, the RDF could locate them.

Air Chief Marshal Sir Hugh Dowding was armed with the two most valuable commodities in any conflict: information and time. Dowding also held another trump card. He possessed a cipher machine that could descramble German radio

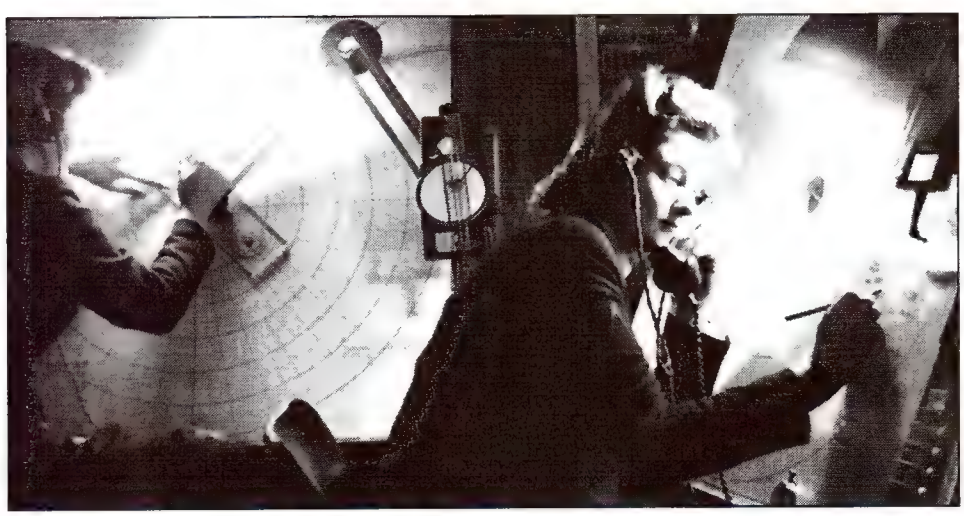


Photo 5-1

Women of the WAAF receive tracking information and plot the progress of incoming German planes in a cookhouse radar room.

transmissions, which meant the British could estimate from the transcripts of German transmissions the Luftwaffe's current targets and the number of aircraft involved in a strike—often before the planes even left the ground.

While history often paints the Battle of Britain as a David-and-Goliath struggle, the sides were much more equally numbered. The RAF was short on fighters, but it was armed with the RDF and observation and communication systems. The Luftwaffe pilots certainly held an advantage in pilot experience. Unfortunately Britain, eager to increase its pilot force, made the mistake of hurrying pilots through combat training—a mistake later made by the Luftwaffe. Through Dowding and Churchill's leadership, the British correctly applied their manufacturing efforts to the creation of fighter aircraft. In fact, British factories produced planes so quickly that the RAF ended the Battle of Britain with more planes than it began with.

The Battle of Britain began on a cloudy day July 10, 1940. Charles Cooke, an RAF Spitfire pilot, noticed a Do-17 reconnaissance plane rising up above the clouds. He ordered his wing of three planes to attack. Though Cooke's plane took several hits and had to return to base, they successfully downed the bomber.

Over the next few months, Britain and Germany would battle over the skies of southern England, each side losing far too many pilots and planes, and each learning quickly about prolonged air combat.

Initially flying outdated Hurricanes, the British fighter forces flew in tight formations. With the rigors of formation flying taking most of a pilot's attention, he had little time left for scanning the air for enemy aircraft or reacting when one was spotted. The Germans, on the other hand, had learned well from their experience and flew in loose formations, the Me-109s of a group flying at staggered altitudes to maximize visibility and reaction effectiveness.

It wasn't long before the British pilots realized that their formation flying was a hindrance. They soon developed the Finger Four formation—planes flying in a staggered wing as if at the tips of an imaginary hand. Success rates improved immediately.

For Goering, the main thrust of this phase was the bombing of southern England, and Germany's twin-engined bombers bore the brunt of the mission. Luftwaffe pilots flew Me-109s for

support, but the planes suffered from limited range. An Me-109 had a flight time of roughly 90 minutes, and 30 of those minutes were eaten up in takeoff, landing, and navigation chores. That left pilots with a time frame of just under 30 minutes in which to fly over British soil.

Making matters worse for the Germans, many of the Me-109s were fitted with a single bomb that made the planes consume more fuel and become less maneuverable. As a result, the pilots often dropped their bomb at the first opportunity to regain their plane's flying capability.

As the battles raged, the tenacious Britons continued business as usual, learning to live with the threat from above. Each day sorties resulted in dogfights that claimed both British and German pilots, and soon the Battle of Britain became a war of pilot and plane attrition. Britain won the battle of numbers of planes not lost but suffered a serious shortage of pilots.

These air battles over England often consisted of British Spitfires (IIs, IIIs, and IVs) against the German staple single-seat fighter, the Me-109. The Me-109s frequently served as short-range escorts to Heinkel He 111s and Junkers Ju 88A bombers. Occasionally a single Spitfire pilot would fly in a sector observational patrol and encounter flights of bombers, both escorted and unescorted.

You can recreate the feel of an encounter with a flight of Ju 88s by playing an Intercept training mission. It is worthwhile to note that the Spitfire IX and the Ju 88S found in *Aces Over Europe* are much later evolutions of the planes flown in the Battle of Britain, but the tactics and visceral effects are very similar.

FLY SINGLE MISSION: TRAINING: INTERCEPT: RAF

You will begin the mission flying at 9000 feet with an airspeed of 200 mph. Throttle up to 80 percent and keep an eye out for the six Ju 88s approaching from your left. The Ju 88 features a rear-facing gun fired by the bombadier and a forward-fired gun fired by the pilot. The plane is most vulnerable from the rear underside, and the pilots fly in formation to avoid this exposure.

Turn your Spitfire to follow the bomber group and keep your distance while you gain an altitude advantage. Switch to the External view to pick out the most vulnerable bomber in the rear of the flight.

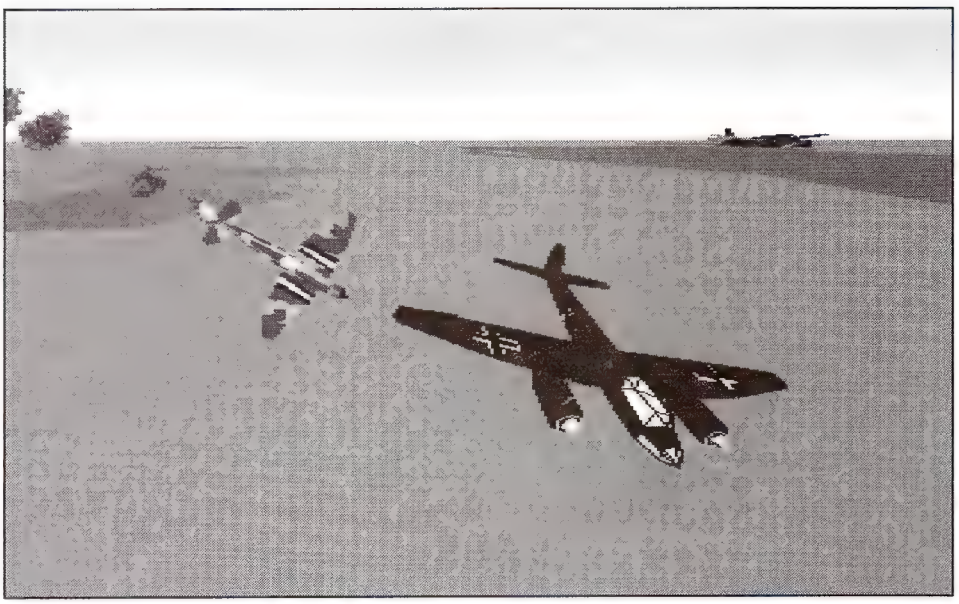


Figure 5-1

A Ju 88 goes down under a hail of bullets from an RAF Spitfire.

You will want to power dive (gaining speed) to an altitude below the target. Then swoop up for a full-guns attack on the belly. Break left or right or dive steeply after the attack run and before you get into the bomber's front-gun targeting range.

When flying solo against a group of bombers, take your time. Plan your attacks on the single bomber that is most vulnerable, initiate an attack, then break away. Your superior mobility and speed will make this tactic work best, even when outnumbered as in this mission.

If, however, you know that the bombers are nearing their target, you will want to mix it up quite a bit more. Initiate formation-breaking attacks from fast dives in an attempt to take out as many as possible. Even if you don't score a hit, you will force the bombers into evasive maneuvers that will hamper their chances of placing their bombs on target.

The Luftwaffe Turns to London

For the entire battle until the fall of 1940, Hitler had kept the bombers off London. On August 24, a Luftwaffe flight took off to bomb industrial targets. The lead planes were outfitted with radio direction-finding systems. Cloudy weather made for a difficult flight, and the planes not equipped with radio navigation aids lost sight of the flight leaders.

Caught in a hail of flak and unsure of their location, the bombers dropped their bombs and turned to retreat. They had unintentionally released their bombs on London. Britain launched a retaliatory strike on Berlin that proved ineffective, but it served as a wake-up call to Goering. Goering, who had assured the German people that no enemy bomber could reach Berlin, had been proved wrong. For the next weeks, Britain and Germany traded sorties until Hitler was forced to authorize a major payback to the Britons. On September 7, a flight of some 250 bombers and 500 fighters took off for London. The true invasion of Britain had begun.

Churchill, always a strategic thinker and concerned with the overall ebb and flow of the conflict, was challenged by the German focus on London. For Churchill, "London was like some huge prehistoric animal, capable of enduring terrible injuries, mangled and bleeding from many wounds, and yet preserving its life and movement." Some have even speculated that he hoped to turn the Luftwaffe's attention to London when he ordered the raids to Berlin. London could take the punishment, he reasoned, and the resolve of his people would be strengthened. Churchill also thought that the bombing of London would attract the Americans' attention and could possibly bring them to England's aid.

The bombing of London lasted until May 10, 1941, but after a victory on September 15, 1940—known as the Battle of Britain Day—the RAF turned the tide after battling an assault of 400 bombers and 700 fighters. On September 17, Hitler postponed the second phase of his Operation Sea Lion indefinitely. By that time Goering had begun to fall out of favor and had lost interest in the campaign.

The raids still came, pummeling London with bombs, but the RAF had gained a permanent foothold. The exhausted Britons kept up the fight and looked to Churchill for support. Ever the strategist, he fabricated a story of an eminent invasion to build up their morale.

Now Hitler turned his attention elsewhere, and German propagandists insisted that there had never been a Battle of Britain—simply a small campaign of attacks on Britain from 1940 through 1941. In the minds of the Germans, they never lost the battle; they only chose to divert their energies elsewhere.

The War Grinds On

In the months and years that followed the Battle of Britain, WWII settled into a pan-Continental struggle for territory. In late 1940, Japan joined the Axis and the Pacific war developed after the December 7 surprise attack on Pearl Harbor.

In the west, North Africa became a major theater of conflict. To the east the Germans sought to solidify and expand their territory by turning their attention to Russia and laying siege to Leningrad in September 1942. The Russian campaign lasted for the next four years and became a land-dominated battle of attrition in the harsh winters of Russia and Eastern Europe.

In the air over Western Europe, the RAF and the Luftwaffe continued a strategy of ongoing bombing missions. Daylight missions were scarce, but at night the RAF would launch attack after attack on Germany, focusing on the urban centers. These strategic bombing raids sought to cripple the will and resistance of the German people. However the reverse may have been true. Now Luftwaffe pilots had a reason to fight—the protection of their homeland and their families. No longer only an idealistic struggle tied to Hitler's concept of the great Reich, the war became a more traditional struggle fueled by nationalistic patriotism that only strengthened their resolve.

In December 1941, the United States officially entered the Second World War. The raid on Pearl Harbor brought America's energy to the Pacific, and on December 11, Germany and Italy declared war on the United States.

The USAAF 8th Air Force had moved into southern England. The central strategic doctrine was a modification of the prewar bombers-will-always-get-through doctrine. Instead of focusing on terrorist bombing and driving Germany to its knees from a breakdown in morale, the USAAF was much more pragmatic. It would use bombers to lay waste to the gears of Hitler's Wehrmacht. Goal number one was to annihilate Ger-many's industrial infrastructure.

In the early months the effect of the 8th Air Force's presence in Europe was not as promising as many had hoped. The strategic command still had to refine its campaign execution, and many of the necessary supplies were rerouted to the African Front, where progress was much more visible. Also, a campaign such as

the one the 8th desired to carry out required time to build up the Air Force to its proper strength.

In early 1943, the 8th began its long campaign to bomb Germany. The Luftwaffe was ready for them. Even though the B-17s were heavily defended bombers, the gunners could not keep the German planes at bay. Flak tore into the flights of unescorted B-17s. Luftwaffe pilots also took their toll of the Allied bombers. According to USAAF policy, a crew had to fly 25 missions before retiring—yet the average mission expectancy for a bomber crewman was eight missions. Naturally, these grim statistics of the early unescorted bomber missions took their toll on the crews, and morale crumbled. When called to a mission briefing, the crews were dazed. Navigators scratched down necessary notes, but their minds wandered. Would this one be their last?

Inside the B-17, fear would take over when the navigator announced over the plane's communication system that they had entered German airspace. As they flew over flak batteries, the firing would begin. The crew would watch the seemingly harmless puffs of flak float through the sky in all directions. Slowly the flak would "walk" toward them as the gunners adjusted their firing from the ground.

All too soon the crew could hear explosions over the din of the four roaring engines. Still closer, and the shrapnel would ting off the fuselage—it sounded like gravel under the fender of a fast car, only this was deadly.

Photo 5-2

The USAAF 8th Air Force takes over an RAF airfield in southern England.

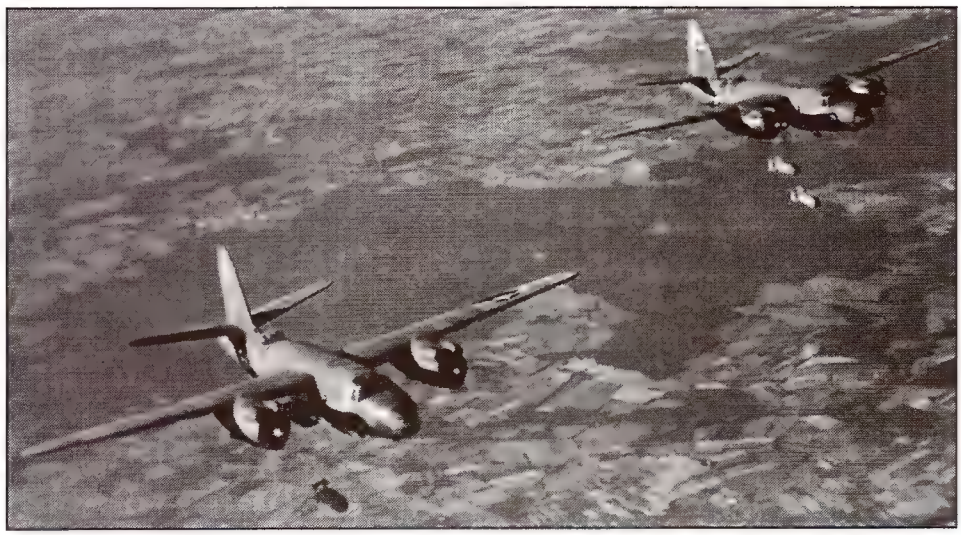


Photo 5-3

A pair of Martin B-26 Marauders let loose their 250-pound "gp" bombs.

If one of their fellow planes was hit and going down, they would count the open parachutes left behind and hope that their friends had made it out alive. Then as suddenly as it had begun, the flak would stop. In the relative silence of the engines, the crew would wonder: will it be clear sailing? Are the German pilots on their way? Then someone would shout "bandits at eleven o'clock" and they would run to their stations. Soon steaming shell casings littered the bomber floor—the odds were ominous.

These unescorted B-17 bombing raids proved to be too great a loss for the 8th Air Force. In the late fall of 1943, bomber crew losses were ebbing up to 40 percent; aircraft losses were nearing 30 percent. It was not a rate of attrition that should continue, so in October 1943, raids into Germany were temporarily suspended until the USAAF could make the logistical adjustments necessary to allow fighter escorts for the bombing missions.

Even though the 8th's losses were significant, the same was true for the Luftwaffe. By the fall of 1943, Germany had lost over 16 percent of its available fighter force. At the same time the 8th called off its German bombing missions, the Luftwaffe was well over 40 percent mission losses for its intercepting fighters. It was clear that the air war was shifting from the periphery of Europe to an all-out war of airborne attrition above the Reich. Who was better positioned to win such a war still remained an unanswered question.

Fighter Forces

By the beginning of 1944, the 8th Air Force had built up its fighting force to peak strength. In October of 1943, the 8th documented 535 operational bombers and 426 fighter planes. By January 1944, they possessed nearly 1000 bombers and over 700 flight-ready, front-line fighter planes.The Luftwaffe, under the constant badgering of Adolph Galland, by this time had increased its production of Focke-Wulf 190s and Me-109s.

The P-38 Thunderbolt Lightning Comes of Age

In late 1943, the P-47 Thunderbolt was fitted with a droptank that extended its range to over 300 miles. Now for the first time the 8th could count on temporary fighter escort. In the following months, the P-38 was also modified with additional wing tanks, extending its raid to over 500 miles. Already a pilot favorite in the Mediterranean and Pacific theaters, the P-38 proved to be a valuable escort. Now when the P-47s would turn back due to lack of fuel, the P-38s still held their formation in bomber escort.

A primary goal of German fighters was to draw the new escorts away from the bomber formations and then engage in single combat. Then other Luftwaffe planes would attack the unprotected bombers. The Luftwaffe practiced the strategy of using fighters to draw off other fighters and then using the slower Ju 88 twin-engined bombers to attack the bomber formations with wing-mounted rockets.

Soon the Allied pilots recognized this tactical approach and stayed with the bombers no mater how tempting it was to break away for a kill. As a result, the Allies' per-pilot kills went down and losses to the bomber wings dropped to sustainable levels.

The P-38 could take an enormous amount of damage and still retain the ability to fly, and the hollow-core fuselage design meant that although many bullets and shells struck the plane, the probability of those shells striking the pilot was reduced.

In one mission—on November 13, 1943—47 P-38s were left to escort the bombers to Bremen as the P-47s turned back. Set on by well over 200 Luftwaffe planes, the P-38s held true to the bombers they were charged with protecting. Only two P-38s went down as confirmed kills in the hands of the Luftwaffe pilots,

but five other planes failed to return to base. Nearly 20 of the returning planes were heavily battle-damaged. One pilot was able to fly his fighter back with only one functioning engine; and as the ground crew and technicians examined his plane, they discovered over 100 bullet holes and five, 20-mm shell punctures. The pilot himself was unhurt.

Even though the P-38 proved itself to be an able, hearty escort fighter and one which gained the respect of the Luftwaffe pilots, it had one major flaw: the plane's unique shape. Since such a premium was placed on visual identification in the air war, the odd, twin-tailed shape of the P-38 made it an easy target to identify at great distances. A Luftwaffe pilot needed only to see a P-38 bank to know that it was an enemy. The P-47, on the other hand, looked very much like the other single-engined planes in the air, therefore delaying combat until identification was made certain.

P-51 Mustang

During the winter of 1943, it was becoming evident that the P-51 Mustang could evolve into a long-range escort that would be more maneuverable than the P-38 and able to travel far greater distances than the P-47. Its traditional design made it appear more anonymous at greater distances than the P-38.

Major General William Kepner, of the RAF, felt that the P-51 was "distinctly the best fighter we can get over here." At the end of 1943, however, all P-51s were being assigned to the 9th Air Force to provide tactical air support for the developing Operation Overlord—the Allied invasion of Germany.

The quick fix for the 8th came by placing a number of P-51s (the 354th Group) under command of the 8th even though they were still technically part of the 9th. This was done in preparation for a major bombing campaign planned to cripple the German aircraft manufacturing capabilities.

Big Week

The preparations for the USAAF's Big Week, code-named Argument, had been underway for many weeks before the let-'em-go order was issued over the wire. Argument was to be the

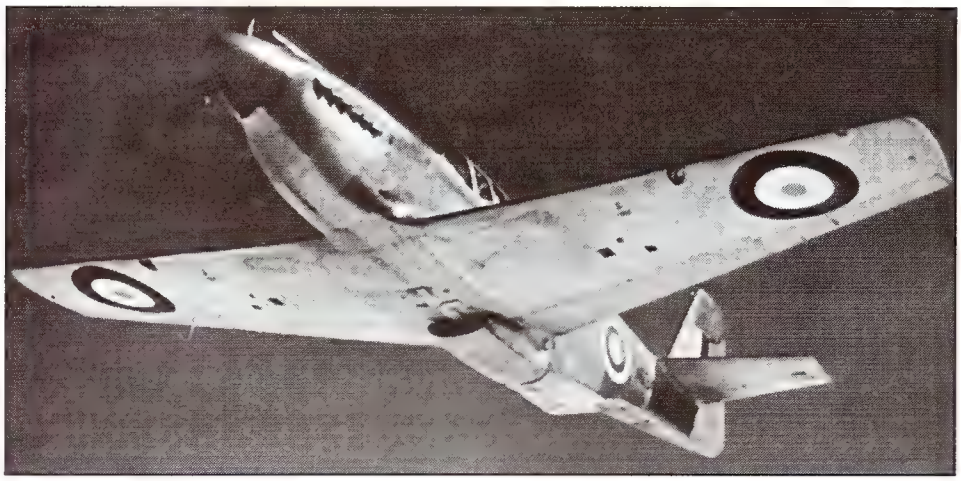


Photo 5-4

An RAF version of the North American P-51 Mustang

largest strategic operation yet planned in the USAAF's history, and it required an entire week of clear weather.

The principal mission of Operation Argument was to cripple the Luftwaffe fighter-production facilities, focusing mainly on the plants that manufactured fuselages. The Allies believed bombing these targets would hamstring the Luftwaffe more effectively than attacks on engine- or weapons-manufacturing centers. Argument also targeted the bearing plants in Germany because of their strategic importance and vulnerability. The plants were in concentrated locations and especially vulnerable to bombing attacks.

The missions would call upon 16 wings of heavy bombers, over 1000 planes, and 17 fighter groups from the USAAF and 16 RAF squadrons totaling nearly 900 fighters. Twelve primary targets were identified and on February 20, 1940, the first sorties were launched.

The massive daylight bombing raids lasted until the 25th of February, and in the end the Allied bomber losses topped out at over 200. The fighter losses, however, were low: the RAF and USAAF lost 28 fighters combined. The low number of fighter losses grew from a change in Luftwaffe fighter strategy. Germany knew that the Allies hoped to cripple their aircraft-manufacturing capability, and in desperation the fighters attacked the bombers almost exclusively, spending less time drawing away fighter escorts.

Figure 5-2

Map of the 15 principal targets of Big Week, code-named Operation Argument, February 20–25, 1944

In the previous months, the Luftwaffe had utilized fighters to draw off the sparse fighter escorts and then attacked the bombers with the twin-engined Me-110 and Ju 88. Now that the P-51 Mustangs were flying escorts, the competition was just too tough for the less nimble twin-engined planes to handle. On February 20, the Zerstorergeschwader Me-110 fighter squadron launched 13 planes to intercept approaching bomber formations. A few minutes later, three more planes were launched to join the initial group. When they arrived at the intercept point, they found the skies empty. The USAAF fighters had surprised the first formation, blinded by the sun, and shot down 11 of the 13. They had then turned their attention to the airdrome, strafing the airfield and taking out 9 more planes on the group. The twin-engined plane had lost its effective edge as a bomber destroyer for the Luftwaffe.

While the Allied losses were heavy, it was still a strategic victory. In the cold calculus of logistical planning, the Allied air forces were in a position to handle the 20 percent losses due to attrition while the Luftwaffe, whose losses topped 33 percent in February, could not sustain that rate of decay. The wholesale destruction had wreaked havoc on the Luftwaffe's production capabilities. While not entirely stopping aircraft production, Big

Week crippled the infrastructure and forced the Germans to break up their assembly process and move from large, visible factories to small shops, underground assembly hangars, and production lines hidden in the rich Bavarian forests.

An Allied Deep-Penetration Bombing Mission

The logistics of a bombing mission deep into Germany were enormous. Strategic bombing had many aims, chief of which was destroying German military infrastructure—ships, shipyards, airframe factories, rail yards, petroleum and synthetic fuel refineries, tank and ground vehicle factories.

Planning of overarching goals, from disabling German aircraft production to destroying refueling capabilities for Germany's ground armies, was coordinated with the many armed services branches. Days or even weeks before a mission, aerial reconnaissance planes were sent out to photograph potential targets and assess whether an already bombed target was still operational. In the command centers in England, files were prioritized as to targets values and status.

All about the Weather

Weather always played a key role in the planning and execution of bombing strikes. Each and every day, RAF Mosquitoes and USAAF B-17s would fly the skies over Europe in order to measure barometric pressure, wind speed, and cloud cover. Eight main weather maps were then drawn for Europe and England utilizing the information gathered in these flights. These maps were supplemented with four upper air maps showing pressure and moving weather fronts. The maps gave the bomber and fighter commands information on the direction and speed of the wind, the downward and forward visibility, temperature, pressure, and humidity. This weather information was therefore distributed via teletype to the various command groups across England, once in the morning and again in the afternoon.

Although the Nordon bombsight provided an accurate means of aiming at high altitudes, weather created great difficulties in accurately pinpointing a bomb drop, thereby hampering effective bombing missions and restricting the effectiveness of fighter escort.

Operations and Planning

In an ongoing process, a bombing priorities committee set the values of prospective targets, based on a myriad of variables. The 8th Bomber Command would use this information, coupled with the weather forecast for the upcoming day, in order to select the targets for the bombing missions. After targets were selected, operational intelligence officers would sort through the target recon photos to analyze the vulnerability of the targets. Information was gathered not only from aerial photos, but also from ground sources—either small intelligence units or undercover operatives.

Once the photos had been analyzed, aiming points were selected—usually a building or installation at the dead center of the target complex. This information would be relayed to the operational research officers, who would determine what type of structure the target was. Research officers were responsible for making recommendations as to proper ordnance loads for the bombers and the fuse settings of the bombs.

The general-purpose (gp) bombs featured both a nose and tail fuse that could be set for a timed explosion after the initial impact. By properly fusing a bomb, the maximum destructive impact could be achieved. In a large factory, for example, a bomb would crash through the roof and then the floor. If the structure was supported mainly by roof beams, then having the bomb explode on the factory floor would do little functional damage to the factory's systems (although the factory workers would be killed). If the fuses were set short so that the bombs would explode as they crashed through the roof support systems, then the entire building could be destroyed as the roof structure collapsed.

Operations was also responsible for setting up the basic flight paths, taking into account the flak concentrations over certain routes and Luftwaffe opposition strengths. Multiple-target attacks would often be staggered by an hour or so with the lead attack bolstered in strength to handle the increased opposition from enemy fighters. The other flights could then sneak in while the enemy's attention was diverted elsewhere.

Liaison commanders coordinated the efforts between the multitude of services, spending hours on the scrambled phone lines, lining up fighter escort from the 9th Air Force, RAF communications systems, and Royal Navy air and sea rescue units. All of

this took place in the morning and early afternoon hours. By late afternoon, another set of updated weather charts was posted and final decisions made to modify or launch the attack the next day. After plans had been finalized, detailed orders were sent out to the various combat wings to plan the operations at a tactical level.

Tactical Planning

In the jargon of war, strategic military operations occur on a grand scale. Strategic bombing campaigns are planned at an air-force-wide level, bringing into the fold the many branches of operations. Concerns are large and all-encompassing in an effort to fit the missions into the overarching plans of attack or defense.

Tactical operations occur at a smaller level—the battlefield maneuvering of a handful of tanks, squad-level infantry operations, wing- and group-level aerial engagements. In a basic sense, the strategy of war is what and the tactics is how.

The various combat wings involved in a bombing mission deal with specific navigation questions such as calculating waypoints, compass headings, and time of flight. They deal with the mundane yet essential details—how much fuel does each plane hold or have available? Knowing that, what bomb load can it carry?

The air combat group is the smallest unit of operation and therefore receives the most detailed and specific orders. The night before a mission, map packets are assembled and last-minute maintenance is performed to make sure that the maximum possible percentage of planes will be available the next morning for combat operations. The USAAF's rule of thumb is that approximately 37 percent of the planes on hand will be combat-ready for any given mission. For maximum effort missions, however, crews managed to squeak out 50 percent readiness. Ordnance crews would load the fighters with ammunition and droptanks if needed and load up the bombers with the predetermined assortment of bombs throughout the night.

Time for Action

For a morning mission, crews were mustered in the dark hours before dawn, often 4 to 5 hours before the actual start of the mission. Generally, the group knew a mission was coming down the pipeline, but the magnitude of the mission and its actual

targets were still a mystery. Needed crews gathered in the mess hall for a breakfast before a briefing.

At the briefing, air crews learned the targets for the day, the escorts they needed to fly, and the times for interception. Flight plans were plotted on huge area maps, often accompanied by posted silhouettes of the enemies and friendlies flying the mission to refresh the pilots' memories. Initially the bomber groups would attend a general meeting and then split up into smaller briefings providing the specific data for the navigators, bombers, and pilots. The fighter groups were briefed on their own, often at bases miles away from the bombers, where they would learn of their intercept points, the concentration of enemy fighters and flak, and the time of their escort commitments.

Before their missions, pilots picked up escape kits that contained survival equipment should they be shot down. They then changed into their flight gear, designed to combat the intense cold of high-altitude flying. The crewmen also emptied their pockets of all personal possessions that might provide information—no matter how slight—to the enemy if captured.

In the few hours left before takeoff, crewmen would attempt to relax as best they could, some writing letters, others visiting the group's chaplain for an impromptu service and blessing. The air was charged with a muted excitement before each mission. Crews and pilots, apprehensive about the dangers of the coming mission, were anxious to get into the air, where their thoughts could clearly focus on their duties.

In the Air

At bases all over England, groups of fighters and bombers gathered for takeoff. The bombers, if possible, took off in groups of three and circled above as the planes rose to meet the formation. Then it was off to a number of intercept points where the mission's bomber stream was assembled for the long ride to the target.

The fighters would gather as well, then turn to a precise heading to meet with the bomber stream and perform their escort duties. Planes like the P-47 would escort the bombers for only a short time, then pull back because of fuel restrictions. At that point another flight of fighters would rendezvous. P-51s and P-38s could travel with the bombers for a much longer duration, sometimes the entire length of time the bombers were over Germany.

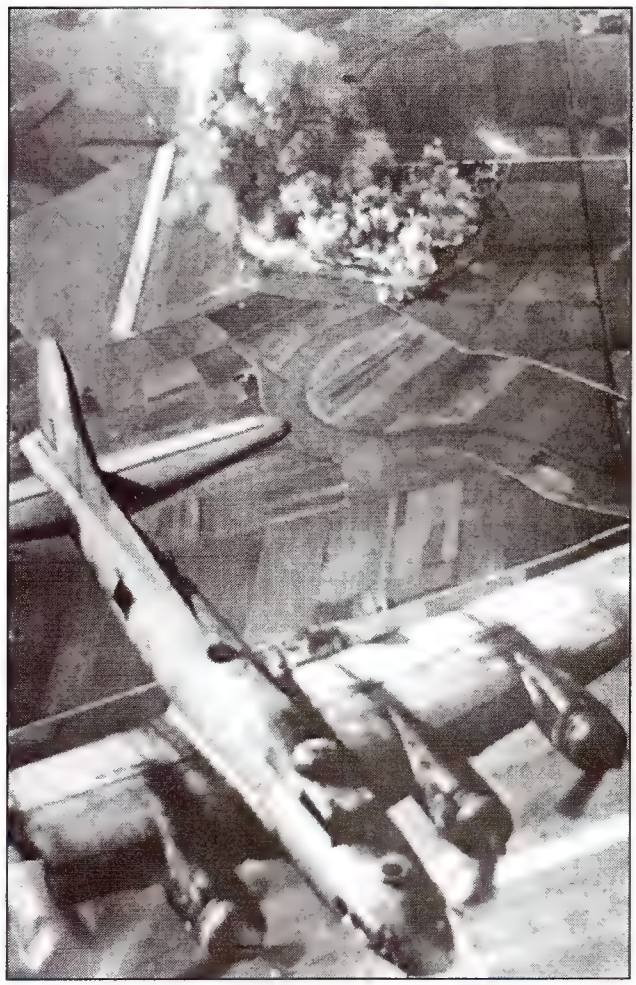


Photo 5-5

A B-17 flies on as its bombs still smoke in the distance.

Bombing Run

As the bombers reached the IP point (the location where they would turn to make their bombing run) the lead plane would release two flares 5 seconds apart and then turn toward the target. His group would follow, and the additional groups in the stream would either follow suit or travel a set time past the flare to initiate a tighter turn. This effectively split up the tight defensive formation of the bomber stream, but it optimized the pattern with which the bombers crossed over the targets. As the groups neared the target, they were the most vulnerable to enemy attack because evasive maneuvers were impossible. Precise control of the plane would switch to the bombardier. Utilizing the sophisticated Nordon bombsight, he would lock on the target and adjust the plane's course ever so slightly to assure a clean run. Since the bombs would be traveling several hundred miles per hour when released, the bombardier had to calculate the drop. Moments

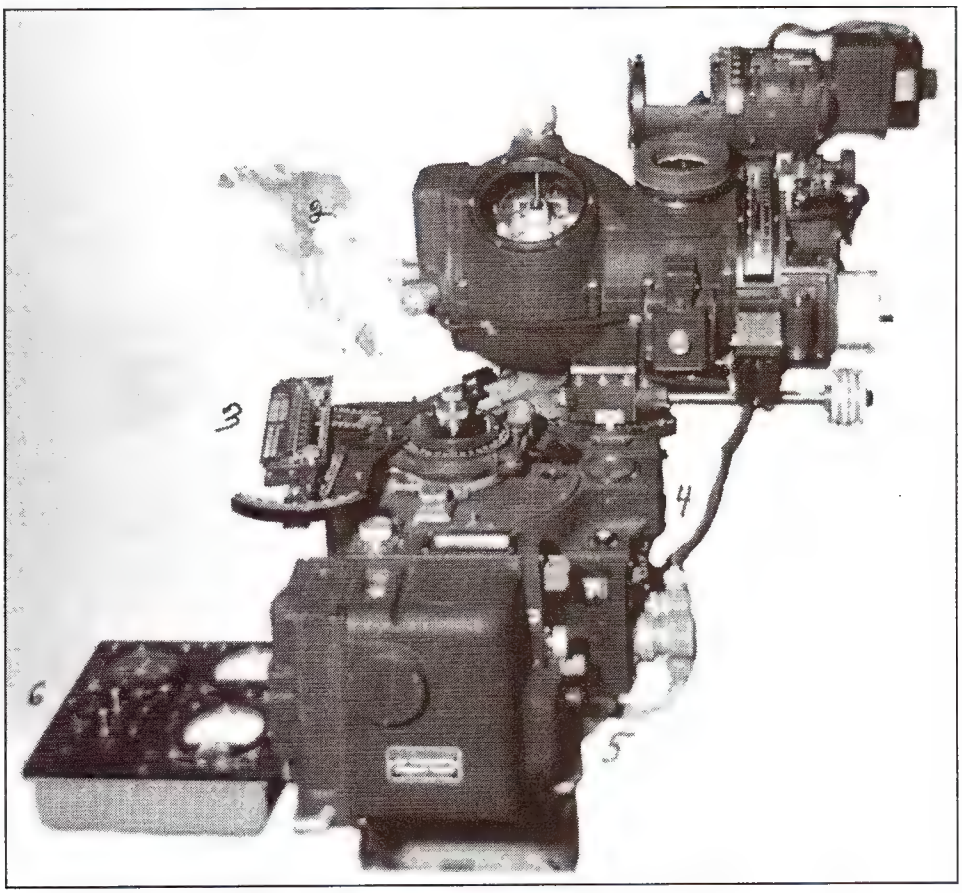


Photo 5-6

The Nordon bombsight (made in Annapolis, Maryland) featuring a Maxson reflex sight

before the bombs were released, the radio operator would switch on the belly cameras. Then with a twitch of his thumb the bombardier would release the bombs with the call "bombs away!"

On-The-Fly Logistics

The massive amount of cross-service coordination that made strategic Allied bombing possible was an incredible feat. Data was gathered, processed, and disseminated constantly, all leading up to a precise set of orders for individual pilots to follow. In the massive bombing raids of 1944 and 1945, the individual fighter pilot was a vital part of a gigantic offensive organism geared toward delivering bombs precisely on target.

While the plans looked smooth on paper, each and every mission was fraught with contingencies, unexpected weather conditions, surprise resistance (or no resistance at all when some was expected), and botched orders. In the words of one B-17 navigator, "In war, nothing ever works as it's supposed to. That's the nature of the thing. It was amazing that it even worked at all."

FLY SINGLE MISSION: ESCORT BOMBERS: U.S. ARMY AIR FORCE

In this mission, set up the parameters so that your flight wing will consist of four pilots (including yourself), the other of whom are veteran pilots. Select a P-47D Thunderbolt, a heavy, rugged plane that in sheer numbers alone was the most prevalent escort fighter of the war. While it was not nearly as nimble as the P-51 and could not fly as far, many pilots felt very comfortable behind the huge engine and bubble canopy of this plane. Choose Novice pilots flying Bf-109Gs as your primary opposition. The 109/P-47 matchup was perhaps the most common plane-to-plane encounter over Europe.

Single missions that are not training or ace missions will be set on random dates with the targets and opposition varying nearly every mission. This feature makes replaying the mission a fresh experience because you never know quite what to expect (just as the real pilots in the war were often uncertain about the nature of the mission and always guessing about the opposition).

For the vast majority of missions that you will fly in *Aces Over Europe*, you will receive a detailed mission briefing. The two exceptions are the Dogfight an Ace and Training missions. The initial briefing will be dated and stamped for the service you are in and the general type of mission you will be flying. You can read about the mission goals and the prevailing weather conditions on this screen.

ESCORT BOMBERS
Your flight will fly P-47D Thunderbolts. Most of the enemies in the area are novice pilots, flying Bf-109Gs. The skies are partly cloudy.
CANCEL
START

Figure 5-3

The Mission Selection screen showing the mission parameters you can control. The boxes around the text are buttons you control to set up the mission parameters you would like.

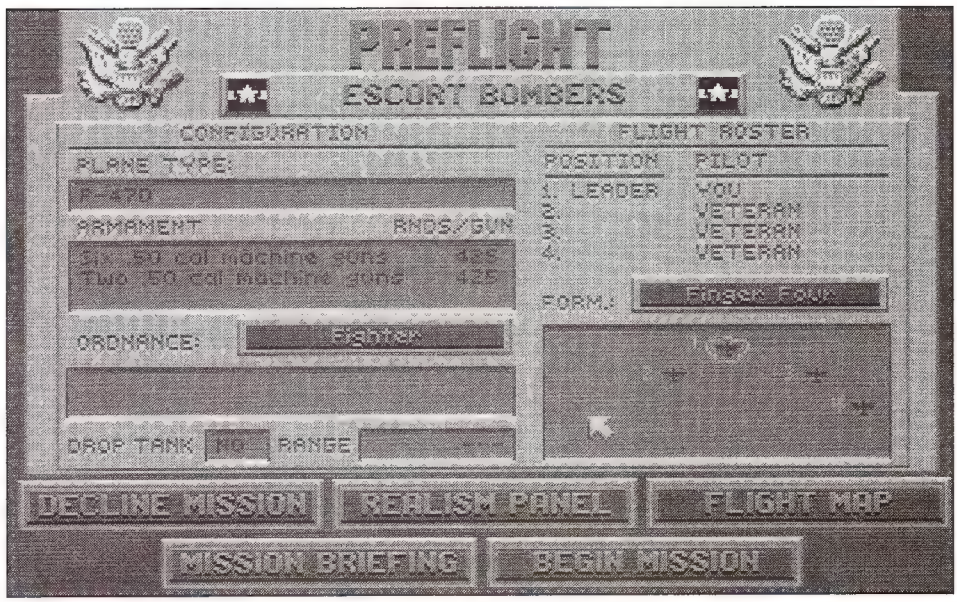


Figure 5-4

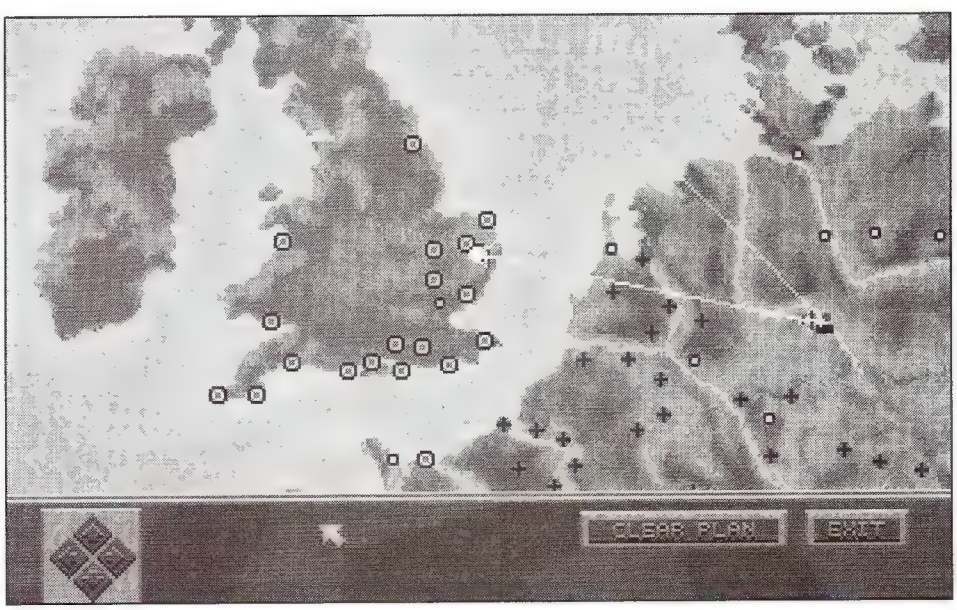
The Preflight Options screen for the Escort Bombers mission. Note that the Finger Four formation is selected for this mission.

Selecting Preflight Options allows you to view your plane's ordnance loadout and information about your flight and the formation you will be flying. If you are flying as the wing leader in a mission, you have the option to alter the default ordnance settings as well as the flying formation.

The Flight Map brings up a detailed map of Europe and England and allows you to view your flight plan and any reconnaissance photos of the targets you wish to strike.

Figure 5-5

The Flight Map for the Escort Bombers mission with the flight plan indicated here in white. Clicking your mouse over any of the indicated bases will bring up information on a site's name and location. You can check your map in flight anytime by pressing the M key.



The Realism Panel allows you to alter the realism and difficulty settings before you begin your mission. (You will find a more functional overview of the mission briefing in Chapters 9 and 11.)

First, you must get your P-47 airborne. Throttle up to full, and when your plane gets up to speed (if you have not toggled off the in-flight messages in the Realism Panel, then you will receive the message Pull Back on the Stick when you reach airspeed). Don't forget to raise your landing gear when airborne and throttle back to between 70 and 80 percent. When you have reached enough altitude, tap the A key to have the autopilot function fly you to the point where you intercept the bombers.

In Aces Over Europe, *you are not given compass-heading briefings. You are not required to navigate by the compass, so the only means to accurately guide you to targets and navigation goals is to use the autopilot function (the A key). Autopilot will not work when you are below a specific altitude or if there are enemy fighters nearby.*

As stated earlier, in the escort missions flown in the war the fighters did not take off with the bombers. Often they were stationed miles apart, and intercept points were calculated to maximize the fuel and minimize time of flight for both the bombers and fighters.

When the longer range planes like the P-51 came into the war, they would often meet up with a bomber group and escort them for the majority of the mission.On the other hand, P-47s would often escort in waves of 30 minutes or so before heading back to base.

In this mission when you reach the bombers, gain some altitude (optimally, a 200- to 300-foot height advantage over the bombers) and throttle back to approximately 50 percent to match your speed. You can switch to External view and use either the other three planes in your flight or the bombers to gauge your speed. Remember, it takes time for a plane to slow down when throttling back, so the speed changes are not instantaneous.

When you have matched up with the bombers, you can either fly along for the ride or tap the A key to fly to the bombers' target area. If along the way you encounter any resistance, the autopilot will disengage.

The most important thing to remember about an escort mission is that it is not your goal to shoot down fighters. It is your

goal to make sure that the bombers reach their target and return home safely. Resist the temptation to be pulled away from the bombers to engage in a dogfight in the opposite direction. Stay calm and remember your goal.

This does not mean that you cannot or should not engage the enemy. As the bandits approach, keep with the bombers but keep your view moving. Look left, right, back, and up, and switch to the External view to get a panoramic view of the situation. At some point the bandits will come in for the kill regardless of your being an escort. If you keep a keen eye, you will see the break and can throttle up to intercept them before they can do any damage.

When in a dogfight, having a bandit on your tail is the most dangerous of situations. This hazard can be minimized when flying escort by keeping close to the bombers. The enemy pilots will not close in on your tail because of the defensive fire of the bombers. You are not their primary concern. Use the bombers' sphere of protection to maintain an advantageous position, and don't stray so far away that a fighter can pick you out.

When the bandits break for their attack, if you are in proper position then you have every advantage. They will be concentrating their efforts on the bombers, so you can cut inside their break and pepper them with fire before they have a chance to perform any evasive maneuvers. Fly carefully when flying

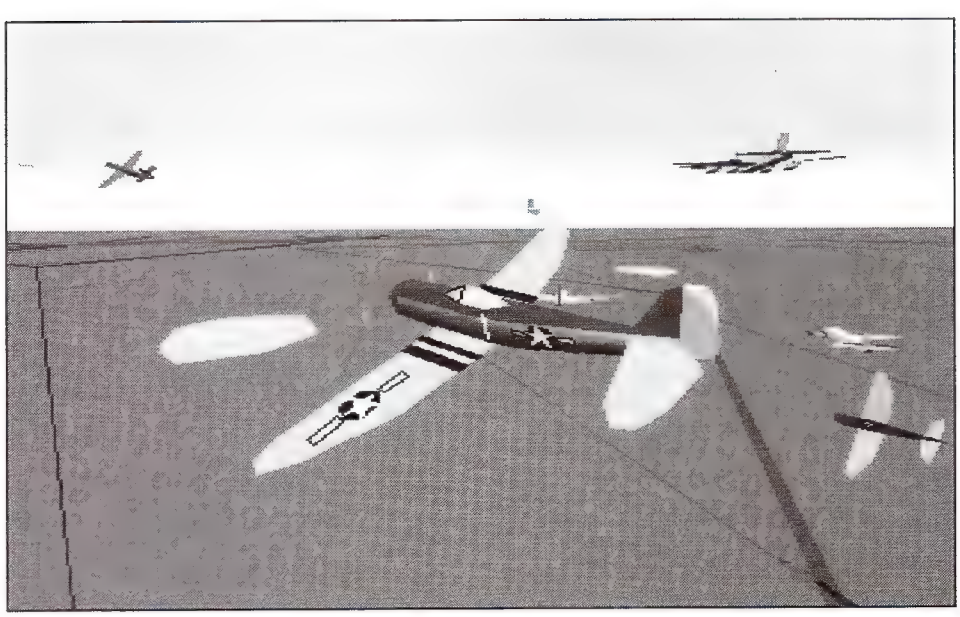


Figure 5-6

Breaking in a pursuit turn, a P-47 and his wingman cut through a B-17 formation to chase an attacking Bf-109.

through the formation, and don't jerk the stick when you are in close quarters—it's the quickest way to a short career and a failed mission.

When you are engaged in a dogfight around bombers, increase your speed but think of yourself as tethered to the bomber flight. Never venture too far away, and use your speed advantage to circle the bomber group, intercepting the enemy as it attempts to infiltrate this zone.

It is generally good strategy to use Full Guns when attacking if you have reached your target or are heading back. The P-47 packs a lot of ammunition, so you have quite a bit of time to work with. If you are on the tail of an Me-109 and he makes a run away from the bomber flight, let him go. You must discipline yourself to stay in close.

After several passes you should be able to take down one or two of the enemy. In this mission the bombing run was completed during the first enemy attack, so most of the battle took place on the return flight as you were headed for the North Sea over Germany's coast. If you manage to get most of the bandits, just let the remaining one or two planes follow. They will often climb to a higher altitude to make a diving attack. If you have kept your bombers safe up to this point, however, their diving attack will be through an almost insurmountable barrage of enemy fighters.

When the last of the Me-109s has fled or been shot down, tap [A] to return to base. You will have to land your plane to complete the mission. Autopilot will put you over the airfield. You should then fly a mile or so past the airfield, then turn back to land. Since you are the flight leader, your wingmen will allow you to land first. Remember the lessons you learned in the last chapter to place your P-47 safely on the tarmac. If you did your job with a cool head and a keen aim, then the mission debriefing should call your efforts a rousing success.

The Luftwaffe Counters Allied Attacks

Hitler's offensive and brutal war with Russia on the Eastern Front was draining the edge from the German Wehrmacht. When Germany first attacked Russia in 1941, 50 percent of the Luftwaffe's resources were turned to support the invasion. By early 1944, less than 20 percent of the Luftwaffe's forces were

fighting on the Eastern Front. The force of the Luftwaffe was now concentrated on the west, combating the British and American bombing campaign over Germany.

By 1944 Goering was in an awkward position. His natural and aggressive optimism was being eroded away by both the successful bombing raid of the Allies and the rather lackluster results of the Battle of Britain. Goering eventually decided that the Luftwaffe's fighter forces should be bolsters, much as the British fighters had been in their protection of Britain years earlier. The Luftwaffe would direct its efforts to the defensive and utilize this posture to build up aggressive power once again.

Goering worked over the plan again and again until he could see the optimistic possibilities in it—until he was convinced that it was the proper plan of action. Resolute, he was summoned into Hitler's office while his top aides waited anxiously outside. After an hour Hitler's door opened and a pale, defeated Goering marched to his private office, where he buried his face in his hands.

"In that hour," wrote Adolf Galland later, "the fate of the Luftwaffe was decided." Hitler had lost faith in Goering and had steadfastly refused any concept of turning the Luftwaffe into a defensive force. According to Hitler, Germans did not defend but attacked—always attacked.

In the early months of the bombing campaign, the British had attacked at night and the Americans had chosen the daylight hours as the only effective time to place bombs with pinpoint accuracy. In Germany, radar installations were the chief early-warning system employed against the nighttime raids, but the British employed Window, an early form of radar-confusing chaff basically paper-coated with metal foil to fool the radar system.

For many months, the battle of Allied bombers versus Axis fighters seesawed, and the Luftwaffe pilots developed great skill in attacking enemy formations. This changed, however, when the Allied forces introduced the P-51 Mustang as an escort fighter. The plane fared better than both the Me-109 and FW-190.

For Goering this development was a tragedy. The P-51s proved to be such a menace that Goering issued orders that Luftwaffe pilots were to avoid confrontation with the D-51s and instead concentrate on the bombers themselves. This allowed Allied escort pilots the luxury of seeking out German planes well before

they even reached the bomber stream and brought the Allies one step closer to air superiority.

From the Journal of Gerhardt Lichter

1st Lieutenant, Luftwaffe; May 1, 1944

...the sky was clear when I saw them. First I thought to myself, there is no escort; this is good. As we approached and turned so the sun would be at our backs, I did not feel so confident. Ten at least in tight formation closing in over Anklam.

Only the four of us were left between here and the bomb's target below. No radio was needed. We had flown this mission too many times before—together more than we would have hoped. I checked Stinsal on my left, nodded, and pushed the throttle forward. As the shapes grew clearer and became mottled with shadows and insignia, I selected my target—a B-17 on the left of the formation.

I had flown the Focke-Wulf, but it did not feel as nimble as my Bf-109K. Now as I checked my ammunition, I wished for the more favorable loadout of the FW. Closing in, I knew in my heart that there was no chance for us to entirely destroy the flight—not this close to the target and not with so little ammunition.

Shells peppered the sky as we were spotted, and I resisted the urge to fire. Instead, I leaned back into the plane, and searched for the proper aim. Close enough, I began to fire. The plane became almost a ghost in my hands as I closed in, firing still.

Almost upon the tail, I kept firing. Finally the heavy bird began to fall. Black oil sprayed my windscreen and something metal shot past—the rear door of the bomber. A tumbling form with knees pressed tightly into the chest rolled by, just missing the

Figure 5-7

Viewed from the cockpit of a Bf-109K, a close attack-run on a B-17.

propeller disk. I turned back for an instant and again felt that pang of compassion. I saw the dark form disappear but did not see the parachute open.

I broke left and escaped the hail of gunfire a final burst pocking my wing. When I checked the ammunition stores, I knew that I was nearly finished. Perhaps one pass left. So soon and the mission would be over. I had no possible chance of returning a hero this day....

FLY SINGLE MISSION: INTERCEPT BOMBERS: LUFTWAFFE

For this mission, select a flight of four with three Veteran pilots to accompany you. You will be flying Bf-109Ks against B-17 Flying Fortresses, Novice pilots. The weather is partly cloudy.

Remember that in many of the daylight raids, ground observers and radar stations would have picked up the incoming bombers and the Luftwaffe would have attempted a best guess on the bombers' targets and possible intercept points.

Check your Flight Map to get an overview of your mission, and when you're ready choose the Begin Mission option. Throttle your Bf-109 to takeoff speed. You will notice how quickly this comparatively light plane reaches takeoff speed. Pull back on the stick, raise your landing gear, and climb to an altitude of several hundred feet.

Initiating the autopilot takes you to the bomber formation. In a flight of four planes, the odds can be quite daunting. Do not attempt to be a hero. Instead, focus your energies on making careful attack runs on the bombers, selecting the outermost planes as primary targets. Unless you are sure that the bombers are nearing their target (selecting the External view and panning to a bird's-eye view will give you an idea if the target is close), plan your attacks conservatively. If you select the outer bombers, you lessen the defensive fire and can break away to safety much more easily.

If you feel that you have the luxury of time and are a crack shot by now, follow the same heading as the bombers, but at a safe distance throttle up to overtake them and turn into their path to attempt a head-on attack run. This type of attack will allow you the least firing time, so accuracy is of paramount importance. Remember that you will be exposed to enemy gunfire for a relatively short period of time. When initiated from an altitude advantage, this strategy will leave you diving through the

formation; therefore, keep your moves stable so you don't collide with any bombers.

Another tactic that works well is the side attack. Beginning with an altitude advantage, dive down and bank toward a bomber and fire a deflection shot, leading your target. You will pass below, so immediately begin climbing again to attack in a similar diving fashion from the other side. This tactic is very effective, but its value diminishes when you are battling an entire formation because you are vulnerable to defensive fire from the other planes in the formation.

Perhaps the most spectacular—yet difficult—attack maneuver is the overhead pass, which will be covered in detail in Chapter 8. Think of it as a dive-bomb attack on a moving target without a bomb. Experiment with it if you are interested.

You will notice that the Bf-109K, while a nimble plane to fly, doesn't pack much punch into its weapons stores. You will need several full-gun hits to take a bomber, and even a very good pilot would be lucky to take out more than two bombers in this mission.

Keep your attention focused on carefully planned attacks and escapes, and keep a watchful eye on your ammunition supply. When you are out of ammo, turn tail and flee from the bombers at maximum throttle. The wingmen that are left will follow you and in all probability will have exhausted their ammunition as well.

Figure 5-8

A Bf-109 dives away from a near miss with a B-17G Flying Fortress.

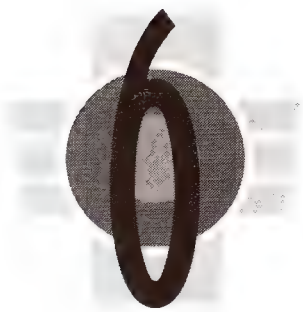
When you get far enough away from the bombers, autopilot will take you back to your airfield. Although turning and running is not a glorious action, it is essential for staying alive. When you are playing a career game, it is especially important to know when you have completed a situation and when to run. Once you have landed, check the mission debriefing to see if your wing's performance hampered the Allied bombing mission.

This mission is an especially good mission to save to tape because of its short duration and the multitude of tactics that it presents. Watch the entire confrontation from an External view to get a feel for how you and your wingmen attacked the bombers. You can also choose the Enter Sim option to reenter the battle and try out new maneuvers, increasing your offensive vocabulary.

Strategic Bombing Campaign

Initiated in full force in 1943, the Allied strategic bombing campaign was a vital tool of constant offensive pressure that lasted until the end of the war. As they darted through the moving armada of the bomber stream, Allied and German fighter pilots battled in two differently fought wars. The Allied escorts kept a close eye on their charges, the lumbering bombers, while the Luftwaffe pilots peppered the enemy bombers and fighters with their bullets in a desperate attempt to stem the increasing tide of daylight bombing raids into Germany.

All the while, another threat was looming in the background. As the cogs in Hitler's war machine were incessantly destroyed by Allied bombing raids, Operation Overlord was becoming a reality.



The Weapons of Air Superiority

The aeroplane is good sport, but worthless for use by the Army.

Ferdinand Foch, 1911

As the above quote indicates, the earliest airplanes garnered little respect as weapons of war. True, they were spindly, ungainly machines crafted of bent wood, cloth, and wire—hardly worthy of generating fear and trepidation. In fact, perhaps the most fearsome aspect of those early planes was the actual flying of them, often considered a display of foolhardy bravado, a disaster invited to happen.

Many of the first planes were constructed in garages and workshops by a small team of individuals who not only designed the craft but also wielded the tools and piloted the results. It was not until later in the First World War that large shops began utilizing Henry Ford's assembly-line concept to increase the rate of production. The planes coming out of European plants at the end of the war, however, still were fragile flying machines.

Deep into the Second World War, the production of planes was an entirely different story. Mounting losses meant that fighters and bombers had to be replaced at an alarming rate, and the technological struggle between the Axis and Allies lead to advancements occurring at a fever pitch. There was always something to be improved upon, always some feature of an enemy's plane that made it superior, always a way to pack more firepower into a single-seat fighter. New versions of planes often entered production before adequate testing could be performed.

More than anything, though, the fighters of the late war had evolved into sophisticated aerial weapons capable of taking down several planes many times their size. These lean machines constantly struggled between the balance of maneuverability, speed, and firepower—each possessed its unique advantages and disadvantages. Some pilots favored blazing speed, others preferred tanklike indestructibility, and some saw the pure punch of massive firepower as the great equalizer. Every fighter in the war and every fighter you can fly in *Aces Over Europe* is a sophisticated, deadly weapon.

Building the Planes of War

In the years just preceding the Second World War, the United States began a series of programs to manufacture an impressive arsenal of military aircraft. The Air Corps launched a 5500-plane program in the spring of 1939 that was eclipsed in 1940 when President Franklin Roosevelt called for a long-range goal of 50,000 planes. As it became clear that the Nazi threat in Europe was real, America increased its planning and production to a wartime level. It worked concurrently with England to share developments and plane deployment. On the 30th of January, 1942, Congress appropriated $7,144,056,340—the single largest amount ever allocated for military forces—solely for the manufacture and deployment of military airplanes.

Photo 6-1

A navy inspector checking out the gun turret of a B-24 on the assembly line

Until 1940, the manufacture of planes utilized assembly-line procedures but was still essentially done by hand. Craftsmen spent great amounts of time attending to the finish details of the individual aircraft; sanding rivets, setting gaskets, etcetera. By 1942, the American aircraft industry had retooled to incorporate mass-production techniques, producing planes by the thousands rather than by the hundreds. The automotive industry, already employing mass-production techniques, retooled its factories, at government expense, to produce aircraft and parts.

Before the attack on Pearl Harbor brought the war into stark focus, planes were produced on a *group-floor*. Each plane, resting on several support braces, was partially assembled on one part of the factory floor as workers moved from plane to plane. When a fuselage was ready for the next series of steps, it was moved with the aid of a ceiling-mounted block-and-tackle system to another area on the floor. While this method could produce large numbers of quality planes, it was still too inefficient to meet the wartime production quotas.

The factories of post–Pearl Harbor America had a decidedly different look. Conveyors were installed to take the planes through each stage of construction easily, the belts lined on each side with workers and parts. The concrete-floored factories resonated with the sounds of arc welding and rivet driving. Some of the retooled auto factories could boast production rates of nearly

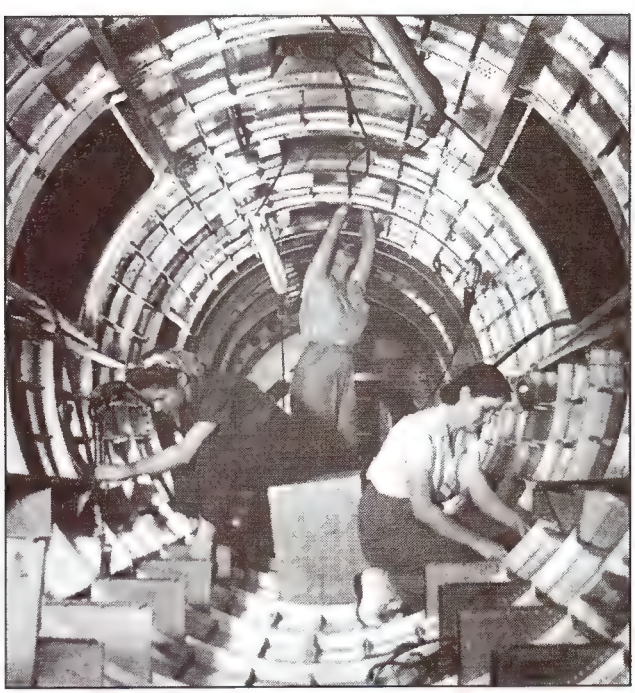


Photo 6-2

Civilian women working inside the fuselage of a B-17

500 fighters per day. Ford Motor Company became one of the most effective producers of aircraft fuselages. One Ford factory, the Willow Run facility, could produce as many airframes in a single month as could the entire German aircraft industry.

Perhaps one of the chief advantages of the mass-production manufacture of aircraft was that unskilled laborers could be utilized as factory floor workers with very minimal training. As the men of the United States headed off to war, the women stepped up to the forefront—taking to life on the factory floor with steadfast determination. By the late war, over 2 million civilians were employed in the aircraft manufacturing industry.

The Economy of War

During WWI the industrial capabilities of all the participants were stretched to their maximum output, with the technology of manufacturing advancing as rapidly as the technology of the military aircraft themselves. In America, the all-out dedication to manufacturing—not just airplanes, but all the materials of war—proved to be key in not only the Allied victory but also in rejuvenating the American economy. This positive economic benefit to the United States, still reeling from the disastrous depression of the earlier years, caused some to label WWII as "the good war."

Photo 6-3

Two women bolting additional horizontal stabilizers to the supports of an American bomber

Table 6-1 Total Military Aircraft Production throughout the War

YEAR	GERMANY	ENGLAND	UNITED STATES[a]
1939	8,295	7,940	2,141
1940	10,826	15,049	6,086
1941	11,776	20,094	19,433
1942	15,556	23,672	47,836
1943	25,527	26,263	85,898
1944	39,807	26,461	96,318
1945	—	12,070	46,001

[a] These figures include aircraft production for both the European and Pacific theaters

That depression was not limited to America but affected the countries of Europe. The disastrous state of the German economy helped to fuel Hitler's rise to power and Germany's search for a scapegoat.

From the German side, one of the aims of the war was to capture and annex territory that would support Germany's economy. From the beginning, however, the Luftwaffe operated from a less-than-favorable fiscal situation. Always struggling to achieve Hitler and Goering's optimistic production quotas, the factories of Germany never seemed to get a leg up. Raw materials were in short supply, and fighting a multifront war drained the supplies faster than imagined. Raw materials could not be processed from newly captured territories as fast as needed, and the German petroleum reserves began to empty near the end of the war.

The Allied forces continued aerial dominance in their bombardment of both the primary and secondary factories contributing to the Luftwaffe's manufacturing capabilities. The Germans had to improvise, breaking down operations into smaller facilities more easily camouflaged to the aerial reconnaissance planes above. By the end of the war the new German jet, the Me-262, was seeing final assembly on abandoned logging roads in the Bavarian forests—the planes covered with camouflage netting to hide them from prying eyes.

The Form of a Fighter

World War I and the years between the wars was a time of experimentation in which designers created biplanes, triplanes,

mono-wings, and saddle-winged planes. By the time the Second World War began, the design of the fighter aircraft conformed to a general consensus: the single-seat, low-winged monoplane with a nose-mounted engine, a tractor airscrew, and forward-firing fixed guns.

While this was the norm, there were certainly variations. The Bell Airacobra featured an engine mounted behind the pilot, with the 8-foot transmission shaft spinning just below the pilot's seat. The de Havilland Mosquito was a twin-engined plane, as was the P-38 Lightning, which featured the unique triple fuselage.

The single-engined plane held a simplicity advantage over the twin-engined fighters. The fewer number of moving parts and control linkages generally created a more reliable airplane that was easier for the field crews to maintain. The low-wing design, while a little less stable in the air than mid-winged planes (because the weight of the airplane was perched on top of the airfoil rather than hanging below) had the advantage of greatly improved structural strength. Low-wing aircraft compensated for the lack of stability by utilizing wings with a dihedral bend. The bend, making the wings form a shallow *V* when seen from the front, helped to center the weight of the plane and the flying forces in the center line of the fuselage, making the handling more predictable.

The fighters of WWI were constructed of canvas over wood, but by the time of WWII the vast majority of the planes utilized all-metal, stressed-skin construction. Aluminum was the metal of choice, either pure or an alloy.

The fuselage construction consisted of cast or stamped supports to which an aluminum skin several millimeters thick was riveted. Generally the skin used in the fuselages and wings was duralumin, an alloy of aluminum mixed with a small amount of copper for strength.

The wings had support joists similar to those of the fuselage, fabricated in the shape of the plane's airfoil and fitted with a skin that often varied in thickness—thicker at the leading edge of the wing and tapering off at the tail edge, where there was less stress. This practice helped to shave weight off the airplane. Often the control surfaces of the plane—the ailerons, flaps, rudder, and elevator—were fabric-covered to save weight and make them easier to repair.

The outer surfaces of an airplane took much flight stress. As a result, stressed-skin construction helped make the planes more durable and more balanced in flight since weight and stress could be distributed more evenly over the entire plane.

During the course of the war, both the Allied and German forces grappled with shortages in materials, causing designers to search for alternatives to aluminum construction. The RAF's de Havilland Mosquito was one of the most successful wooden planes to see service in the late war. The Mosquito's structural supports consisted of two layers of thin plywood surrounding a core of light balsa wood.

The Engines

Perhaps the single most important component of a fighter aircraft was its engine. Some have argued that even the pilot played second fiddle to the engine because without the engine providing sufficient levels of speed, reliability and performance, even the most gifted pilot would be controlling only a flying coffin.

The primary design concern for a fighter engine was basic: how to fit the most power into the least amount of weight. Add to that reliability, ease of repair, ability to withstand damage, and fuel economy, and the designers had their hands full attempting to meticulously balance the myriad of variables to create the perfect engine.

In reality, there were very few engines that stood out above the others; the Pratt & Whitney R-2800 was surely one of the finest engines made. Yet there were just too many variations among the engines from different manufacturers, each boasting some advantage over the other, for a decisive best-of-show label.

In-Line and Radial Engines

The two general classes of engines found on the fighters in *Aces Over Europe* were the in-line engine (in which the pistons line up from front to back) and the radial engine (in which the pistons radiate out from the drive shaft like the petals of a flower).

The in-line engine was liquid cooled and required a radiator and a multitude of cooling lines throughout the heat-producing areas of the engine. Liquid cooling was more efficient than air cooling because the coolant could be sent directly to the areas with the greatest heat buildup—and these ducts could be built

onto the engine's surface. An air-cooled engine had to rely on the passage of air through raised heat sinks to cool the engine and was less efficient.

Perhaps the chief advantage of the in-line engine was its aerodynamic shape. Since the pistons were set from front to back, the engine could be fit into a slim cowling and could better conform to the shape of the fighter's fuselage. In the calculus of engine designers, the frontal area of an in-line engine was less than 1 square inch for each horsepower the engine produced, which is less than half that of the radial.

Radial engines were common fare on the fighters of WWI and saw extensive service in many WWII fighters. Because of their more spindly design, these engines tended to be lighter than in-line engines and could withstand more battle damage. An in-line's cooling system was extremely vulnerable to damage, and a punctured cooling line meant that the engine had only a few minutes of life before shutting down in bellowing clouds of steam and smoke. Generally, a radial engine could take twice the damage of an in-line engine.

Radial engines were also easier to maintain because each piston unit was its own discrete entity; and it was easier to perform major repairs—such as replacing a sheared piston rod—without dismantling the entire engine.

The Propeller

The job of any fighter engine was to drive the airscrew with force sufficient enough to provide thrust for the plane's flight. In WWI and the early days of WWII, the propellers were constructed of wood, generally a laminate cut to provide the necessary thrust. Thin metal plates were often fastened to the leading edges of the propeller blade to lessen damage from collisions with airborne debris. If a wooden propeller was shot or damaged in any way, then the balance of the propeller was thrown off. A divot the size of a golf ball on the propeller, although not significant in the amount of wood lost, was enough to seriously damage the engine. A propeller spinning at high speeds would magnify the damage geometrically and cause the force to be uneven on the drive shaft and the primary engine bearing, eventually breaking up the bearing so that it no longer functioned.

The vast majority of fighter planes featured metal propellers cast into the proper shape—and far less vulnerable to small damage. One of the most significant advances in propeller technology during the war was the variable pitch propeller. A variable pitch propeller could be adjusted in flight, the blades rotated to provide the optimum thrust with any engine RPM level. This feature increased the efficiency of the engines as well as the speed of the aircraft.

Superchargers

The performance level of any internal combustion engine is directly related to the amount of air flowing through the piston chambers as the engine fires. This intake is generally constant and related to the engine's speed, and is mostly a factor of the pressure developed as a piston plunges down in the cylinder during its intake stroke.

To increase the amount of air entering the cylinder, superchargers were added to the engine. A supercharger forced the air-and-fuel mixture into the cylinder at a greater pressure than standard intake alone and dramatically increased the engine's compression ratio and hence its horsepower. Basically, a supercharger ducted the incoming air, mixed it with fuel, and accelerated it through a combination of twisting, smaller-diameter ducts and impeller turbines. This high-speed mixture was then forced into the cylinder during the intake stroke.

One problem with the initial development of combat superchargers was that the accelerated air–fuel mixture could become so hot that it would explode out of sequence, either in the ducting or in the cylinder. The solution to this problem was the development of an intercooler system, a small radiator which was part of the engine's cooling system. The air passing over the fins of this small radiator would cool sufficiently and not combust.

The engine fitted in the early RAF Spitfires, the Merlin III, was an in-line engine rated at just over 1000 horsepower. By 1944, the Merlin 130 engine, through the use of an optimized, intercooled supercharger, was rated at just over 2000 horsepower.

One of the primary enemies of an engine's performance was altitude. As a plane flew at higher altitudes, the air thinned and so did the amount of oxygen that was available to the fighter.

The addition of the supercharger provided a means to extract the most oxygen out of the thinner air, thereby improving the high-altitude performance of an airplane.

Another method to improve high-altitude performance was the introduction of additional, oxygen-rich gas into the supercharger. The Bf-109K utilized nitrous oxide injections at high altitudes to provide an oxygen-rich combustion environment and allowed the plane to continue to generate substantial horsepower even at altitudes above 30,000 feet.

Increasing the Range

In the early years of the war, the effective range of a fighter was certainly limited. Careful consideration had to be given to fuel consumption during bomber escort missions, when the pilots flew at low throttle setting with a lean fuel mixture (more air mixed with the gas). As mentioned earlier, in the Battle of Britain the amount of time that a Bf-109 pilot could remain in the air above England was extremely limited—if the pilot fostered any hope of returning to base.

Planes were rated with a maximum effective range, which was basically the farthest a plane could fly and then return, not taking into account the takeoff, landing, and fuel required to reach the cruising altitude.

In the early escort missions, the P-47s that flew with the 8th Air Force's bombers had to do so in waves, each rendezvousing with the bomber stream for only a limited time before heading back to base.

The implementation of droptanks changed that. Droptanks were external fuel tanks fitted beneath the fuselage or under the wings of the fighter. The thin metal tanks could hold approximately 100 gallons of fuel (this varied from plan to plane) and were utilized upon takeoff as the primary fuel supply and jettisoned when empty.

A droptank greatly reduced the agile performance of a fighter; therefore, if an enemy was encountered, the first course of attack was to jettison the tanks. In *Aces Over Europe,* you will fly missions utilizing droptanks. When you study the Preflight Options screen before a mission, you will see if a particular mission calls for droptanks. If you are flying with an external tank, press the D key to jettison the tanks in a combat situation.

By the time the P-51 entered full service as an escort fighter, the question of a fighter's range changed considerably. With the P-51's massive internal fuel tank (over 250 gallons) and the addition of droptanks, a P-51 could remain in the air for well over 7 hours. The focus, then, changed from mechanical limitations to the physical limitations of a pilot. Could a pilot in a cramped cockpit remain sharp and effective for a long duration?

The Guns

Before the outbreak of the war, the standard armament for a fighter aircraft was a high-speed, rifle-caliber machine gun. Some planes also featured slow-firing heavy machine guns and shell-firing cannons. It became apparent that the small-caliber machine gun would be of little use against the large bombers the fighters would be charged with defeating, so emphasis was placed on creating a heavy machine gun with a reasonable rate of fire and a cannon with significant stopping power (a factor of both the muzzle velocity and the weight of the shell).

The standard weapons of the midwar fighters were .50-caliber machine guns and 20-mm cannons. The .50-caliber machine gun (bullet diameter of $^1/_2$ inch) was very similar to the German 13-mm and 15-mm machine guns. In a fighter-against-fighter battle the machine guns were more than adequate, and neither Allied nor German planes were armored sufficiently to defend against prolonged hits from a heavy machine gun. Although they fired shells more slowly than the heavy machine guns, the cannons packed a massive offensive punch and were the weapons of choice when going against heavy bombers.

Generally the machine guns fired belt-fed ammunition that was loaded into the wings or cowling, depending on the placement of the guns. Cannons fired from either a belt or a cartridge. Great care had to be taken when the ground crews loaded the ammunition into the planes. If a kink developed in the fabric-web belt, the guns would jam—leaving the pilot helpless as he attempted to unjam the guns with repeated firing and cocking. The firing linkages were generally hydraulic or pneumatic and, like the engine's cooling system, were subject to enemy fire. The systems were closed, though, and if the linkages on a gun on one wing were damaged, the other gun would still fire. The resulting imbalance, however, made aiming a more difficult and frantic exercise.

Selecting and Firing Guns in Aces Over Europe

Nearly every fighter in *Aces Over Europe* has several gun options to choose from (see below for specific details). By tapping the G key, you may cycle through the gun sets available to you. A red light will illuminate on your instrument panel to indicate which guns are selected, and your ammunition stores will be to the right of the indicator light. Firing the guns is accomplished by pressing the Spacebar or controller button on your joystick (see Appendix D for the various control options available to you).

Ammunition management is one of the most important skills to master as a fighter pilot, and you must keep an eye on your ammunition stores at all times. Generally it is the best tactic to fire in short, 1- to 3-second bursts when you are sure you have the target firmly in your sight. Your machine guns will generally be adequate against other fighters, but you will want to bring out the heavy artillery against any bombers or heavily armored ground targets.

If you are near the end of a mission or you know that you must destroy a target, selecting Full Guns (even though it will drain your ammunition supplies at the fastest rate) will ensure the maximum punch for your hits.

Occasionally if you are flying with the Realism setting on Maximum, you may encounter problems with your guns jamming. Repeatedly tap the U key to attempt to free the jammed shell from the chamber of your gun.

The Luftwaffe Studies the Tapes

In 1941, the Focke-Wulf 190 was loaded out with two rifle-caliber machine guns and four, 20-mm cannons. During a 3-second firing burst, the four cannons could fire 130 shells. After analyzing gun-camera footage of actual battles against Allied bombers, the Luftwaffe's ammunition experts determined that it took an average of 20 hits with a 20-mm shell (assuming no critical hits) to take down a heavy bomber.

The Luftwaffe's average fighter pilots were hitting the bombers with just over 2 percent of their shots, meaning that over 1000 rounds (or nearly 30 seconds) of continuous fire was needed to down a bomber. In the face of intense defensive fire from the heavily armed American bombers, this was a decided impossibility. The films showed that the Luftwaffe victories came either from their top aces—who could get more of their shots on

target—or by pilots who attacked bombers already damaged in flak barrages.

Work was carried out to develop a 20-mm cannon with a faster muzzle velocity and heavier shells that could do serious damage to the Allied bombers. By the end of the war, the modified cannons could fire nearly 57 pounds of cannon shells and 13-mm bullets during a 3-second burst from all guns. For comparison, the weight of the shells fired from a Hawker Tempest V in a 3 second burst was 40 pounds from its four cannons. The Messerschmitt 262 could fire 96 pounds of shells from its four, 30-mm cannons.

Convergent Aiming

While nose- and cowl-mounted guns fired straight ahead, guns mounted on the wings had to be tuned to a convergence point. Generally, the convergent point or harmonization point was set so that bullets from the wing guns would converge at a distance 700 to 800 feet from the nose of the plane. Because the bullet density in front of and behind the convergence point was light—yet lethal at the convergence point—this type of harmonization favored pilots with careful aim. Pattern harmonization was another method of tuning wing guns, achieved by adjusting the wing guns to provide a general cloud of shells at a predetermined distance from the nose. While not as lethal as point harmonization, it favored less accurate pilots and was more effective when firing 20-mm cannons because the damage potential of each shell was much greater. Ground crews, using targets for testing, would adjust the convergence of a plane's wing guns to match the pilot's preference or abilities.

Problems

Perhaps the most prevalent problem of utilizing an airplane as a flying gun platform was the physical stresses produced from the firing guns themselves. In a large plane, such as a B-17, the mass of the plane more than compensated for the multitude of machine guns firing at all different angles. In a single-seat fighter, the plane was much lighter, the weaponry of a heavier caliber, and the precision of aim was much more essential. Wing-mounted guns would need to be synchronized to fired in sequence; otherwise, the pilot would have to compensate with constant rudder adjustments to keep the plane flying on target.

The recoil from the guns was also an important force since, as each gun or cannon as was fired, it would create thrust in a direction opposite the plane's movement—slowing the plane. Pilots would compensate by firing in short bursts or throttling up to compensate for the drain on speed.

In the beginning of the war, the bullets fired from a plane's guns featured tracer bullets, shells with a small magnesium charge that ignited as it was fired. Tracers would allow a pilot to follow the stream of his bullets to adjust aim while firing. Generally tracers were interspersed with regular bullets since several shells would be in the air at the same time. One problem inherent in tracer bullets was that the additional magnesium charge made the shells heavier than the regular bullets; hence, the path indicated by the tracers was not necessarily the path the bullets were following.

The noise inherent in flying a fighter aircraft meant that a pilot often would not hear the guns of an enemy as they were fired yet could easily see the streams of tracers as they whizzed past the cockpit, alerting him that he was indeed under attack. As a result, pilots firing without tracers would often have a several-second advantage in a surprise attack. Later in the war, many commanders ordered their groups to fly planes without tracer ammunition. As a result, competent pilots who had already mastered the feel of aerial gunnery found that their kill numbers rose significantly.

All guns in *Aces Over Europe* feature tracer ammunition, the shell flaring in red. Because of the limitations of flying a simulation, tracers are necessary to track your bullets as you fly. There is no inherent disadvantage or advantage factored into the game with regards to tracer ammunition.

Also, *Aces Over Europe* allows you to hear if an enemy pilot or enemy bomber is firing on you, giving you a clearer, multisensory overview of the situation. If you hear gunfire or see a tracer shoot past your cockpit, immediately take evasive maneuvers to get out from under the gun.

The Gunsight

While the gunsights from the earliest fighters were no more than the ring-and-bead sights found on infantry weapons, the reflector sights found on most WWII fighters were much better suited to aerial gunnery. The reflector sight, developed in the 1930s,

was a single aiming point projected from a small light source upon an angled piece of etched glass. The pilot no longer had to line up the ring and bead—squinting with a single eye—but could now aim with both eyes open, focusing on the target rather than the sight.

The projected image, often a central aiming point in a circular aiming reticle, was designed so that the image would disappear if the pilot's head was off center. While this type of gunsight helped a pilot get a bearing on where his fire was likely to converge, it did little in the calculation of the deflection angle of the target plane and the amount a pilot had to lead his firing so that the enemy would fly into his bullet stream.

Deflection shooting was a skill to be learned and eventually became instinctual, with the pilots able to accurately gauge the speed of the enemy in relation to their own speed. (For more information on deflection shooting, see Chapter 8.)

Near the end of the war, the British developed a gyroscopic sight that could calculate the deflection angle. A large dial on the sight would be turned to correspond to the type of plane the pilot was pursuing (based on the plane's wingspan). As the pilot turned with his prey, he would adjust the sight so that a ring of tiny, projected diamonds would just encircle the target. The sight would then calculate the amount of lead needed to hit the target.

The gyroscopic sight was met with less than enthusiastic responses, and experienced pilots still preferred to let their instantaneous instinct calculate their shot—it took a second or two for the gyrosight to perform its calculations. Later in the war, though, quite a few Allied planes were fitted with a gyrosight, and it proved to be a significant aid to inexperienced pilots.

In *Aces Over Europe*, all of the airplanes feature reflector sights. It is assumed that when a pilot is looking forward, his head is aligned with the sight. As a pilot, though, you will still need to manually calculate the proper deflection for your shots as well as the offset in your bullet stream for firing while diving, climbing, or banking tightly. It is a learned skill to be able to fire your guns accurately, and one that *Aces Over Europe* models with accuracy.

Other Offensive Capabilities

In addition to the fixed guns mounted on all fighter aircraft, many Allied and German planes were equipped with other

offensive capabilities, making them dangerous ground-attack weapons and deadly air-to-air weapons.

Rockets

The Luftwaffe experimented with wing-mounted rockets first, employing the highly inaccurate but deadly Gr.21 rocket as an antibomber weapon. The Gr.21 was essentially a German mortar shell modified by the addition of a rocket engine. Launching the rocket to a predetermined target was largely a guess by the pilot. The rocket fuel would burn up, and the mortar would fall like a small bomb. Pilots would attempt to lob these shells into a distant bomber formation. Shooting at a high angle from perhaps 1000 yards behind the bombers, they would hope that the falling mortar shell would be near a bomber or two when the time-delay fuse caused the charge to explode. As you might guess, these weapons were extremely inaccurate. If one did happen to find its mark, however, the destructive capabilities were immense and the explosion was significant enough to take out several heavy bombers if they were flying in tight formation.

Occasionally, the Bf-109 and the Focke-Wulf 190 in *Aces Over Europe* are fitted with a pair of Gr.21 rockets fired together. To fire them—or any salvo from a rocket-bearing plane—tap the R key.

Later in the war, the Me-262 was often armed with 24 R4M rockets mounted on slight underwing rails. These pencil-thin

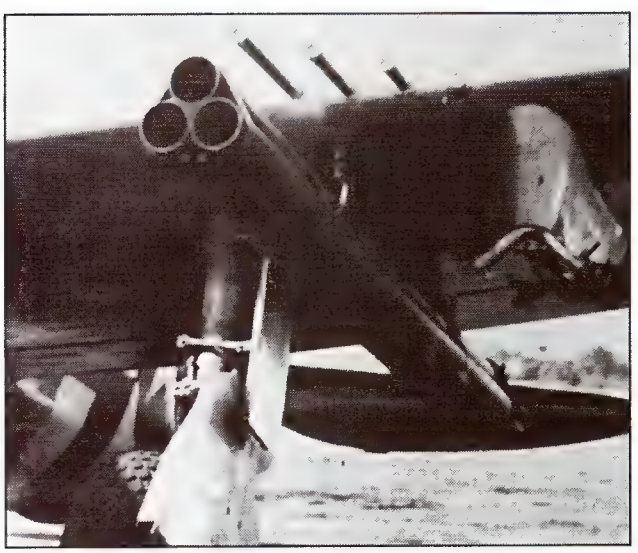


Photo 6-4

Three rocket tubes mounted under the wing of a P-47 Thunderbolt

rockets were ripple fired to create a dense cloud of deadly rockets. When fired into a heavy bomber formation, generally they were sufficient to take out at least one bomber.

Later in the war, the USAAF and RAF experimented with wing-mounted rockets that fired from long bazooka tubes. These rockets, larger than the German R4Ms, were chiefly designed as a ground-attack weapon. The rockets were generally fired in pairs and occasionally could be used as a last-ditch, air-to-air weapon although their accuracy was extremely poor.

All Allied fighter planes in *Aces Over Europe* are capable of carrying these powerful ground-attack rockets, and a salvo may be fired by tapping the R key.

Bombs

While it was the chief role of the heavy bombers to deliver tons upon tons of bombs on factory or refinery complexes, there were times when that type of strike was impractical. It was difficult and inefficient for a flight of high-altitude bombers to destroy a single bridge or take out an enemy pillbox or airdrome. That task went to the fighter planes—generally fitted with one or two bombs dropped simultaneously—that could deliver them with pinpoint accuracy.

While the bombs carried by the heavy bombers featured advanced fusing capabilities, the bombs carried by the fighters were simple detonate-on-impact bombs. Bombs ranged in weight from 100 pounds for light-attack duties to 2000-pound monsters capable of taking out a reinforced pillbox or mangling a bridge.

All of the fighters in *Aces Over Europe* can be fitted with a bomb load. To release the bombs, tap the Backspace key.

The Cockpit—A Home for the Pilot

Although the majority of a pilot's time was spent on the ground waiting for the call to fly again, the true test of his abilities came after he climbed into the cramped cockpit of his fighter. The cockpit of a single-seat fighter, clustered with instruments and control linkages, was a study in utilitarian design. Functionality took precedence over comfort.

The pilot sat in tight quarters on a seat that was as small as possible, with padding reduced to a minimum. Often the pilot's parachute was mounted on his derriere, allowing the bundle to

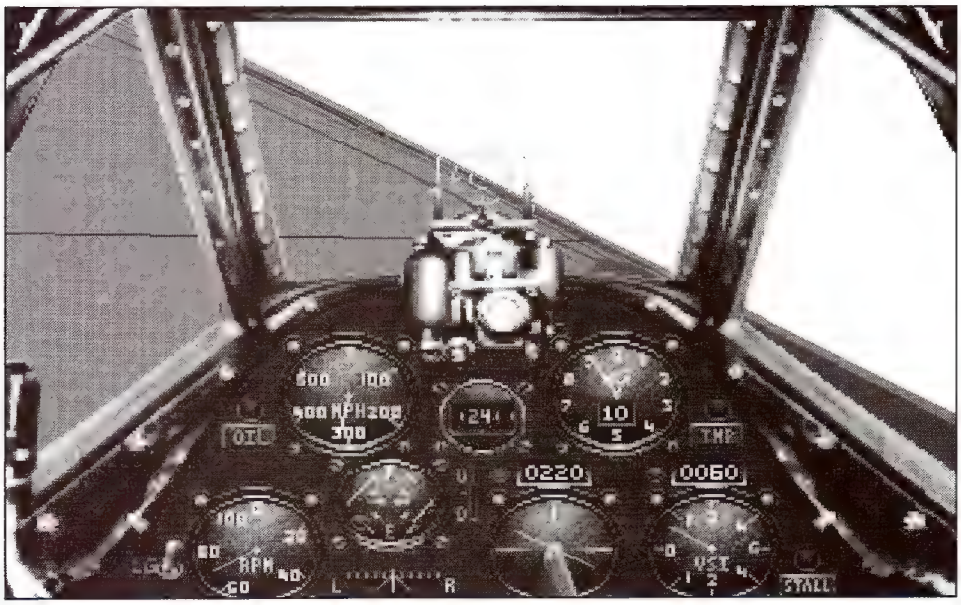


Figure 6-1

The cockpit of a Bf-109 in *Aces Over Europe*

serve as a seat-bottom cushion. The headrest was padded and generally plated with armor for the pilot's protection.

Visibility

The pilot's controls surrounded him—some easy to reach, others awkwardly tucked away between the fuselage braces and stressed skin of the plane. A primary concern for the pilot was visibility. How easy was it to survey the surrounding sky from the cockpit? Some planes, such as the Messerschmitt 109, had an awkwardly designed canopy that made it difficult for a pilot to see down to lower altitudes and almost impossible for him to effectively check his tail for enemies bearing down for the kill. The late-war P-47, however, featured an injection-molded plastic bubble canopy that gave the pilot a truly spectacular—and essential—window to the world.

Controls

Although a pilot had at his fingertips a myriad of controls with which to operate the plane, two controls were essential. The pilot's feet rested in the metal foot pedals of the rudders and were held in place by a strap of cloth so that he wouldn't lose purchase during a dogfight. The pedals operated as a unit; when one was pushed down, the other rose. Through a linkage of thin, steel cables, they controlled the plane's rudder, allowing the pilot to vary the plane's yaw during flight.

The control stick was the basic flight control and rose up from the cockpit floor between the pilot's legs. This large "joystick" controlled both the elevators and ailerons as well as the firing of the plane's weaponry. Through control wires underneath the cockpit floor, the pilot could control nearly all aspects of the plane's flight. Since the control linkages were mechanical, as the plane's speed increased, or the tightness of the maneuver increased, the stick became more difficult to move and often required a pilot to grab hold with both hands in order to execute a maneuver. After hours of flying and battling with the varying resistance of the control stick, a pilot's arm muscles would turn to jelly.

In addition to the central controls, the cockpit featured a multitude of other levers and wheels to adjust the many systems of the plane. Trim adjustments, often made by rotating a large racheting wheel, set the elevator's default position either up or down and required constant adjustment because the plane's weight declined through time as it burned fuel and fired the heavy ammunition.

Oxygen tanks were adjustable to provide the pilot with much-needed air for high-altitude flying, and a small light was included to illuminate the instrument controls during early-morning or night flying missions. Night flying was difficult and dangerous. The pilot's eyes were constantly readjusting for instrument readings while he concentrated on the night sky—for fellow aircraft and enemy alike. He had to move his head constantly in order to minimize the distracting instrument images reflected in the glass canopy.

He had controls that adjusted the pitch of the propeller to match it with the current speed. There was also a lever to control the mixture of air to fuel for the engine's intake, providing a lean mixture for fuel economy and a rich mixture for maximum power in a dogfight or to compensate for thinner air at high altitudes.

One of the most utilized secondary controls was the throttle lever. A pilot constantly adjusted his speed to keep up with his escorts or to get the leap in a dogfight, always keeping an eye on the temperature light to make sure that the high RPMs weren't overloading the engine. The throttle did not directly correspond to speed because there were so many other factors at play—from the fuel mixture to whether or not the plane was diving or climbing or still flying with droptanks or bombs, etcetera.

The throttle in *Aces Over Europe* may be controlled several ways. The numerical keys, (1 to 9), may be used to set the throttle from idle (1)to maximum(9). The F8key will bring the throttle up to 100 percent, and the - and + keys will decrease or increase the throttle respectively. For additional methods of throttle control, turn to Appendix D.

The flaps were generally controlled by a trim control to the pilot's left that allowed him to vary the degree with which the flaps descended from the wings. In that manner he could modify the flight characteristics and stall speed of the plane. In *Aces Over Europe*, the flaps can be toggled up, halfway descended, or fully descended. To adjust the flaps, tap the F key. A vertical indicator on the instrument panel will indicate the position of your flaps.

Certain planes you can fly in *Aces over Europe* are equipped with dive brakes, which are panels on the top surface of the wing that can be raised pneumatically to distort the shape of the wing and are utilized to slow the plane down during a high-speed dive. To toggle on the dive brakes, tap the B key. A toggle switch on the instrument panel will indicate that the dive brakes have been activated.

Most fighter planes of WWII featured retractable landing gear, and all of the planes that you can fly have retractable gear. The P-38 Lightning and the Me-262 featured tricycle landing gear with a steerable nosewheel in front. All other planes featured larger gear that folded from the wings and a small, steerable tailwheel that may or may not retract. The planes were steered on the ground by controlling the rudder because the wheels were linked to the rudder control.

Retractable landing gear was developed to clean up the line of the airplane and to better improve the aerodynamic performance by reducing the drag. As soon as you lift your plane safely off the ground, press the L key to retract your landing gear. Pressing L again as you make your landing approach will lower the gear. In a high-speed dive or a spin, lowering your landing gear will help to slow your plane and increase the chance of regaining control.

After landing, throttle down and apply the wheel brakes (W key) to slow your plane to a stop.

Instrument Panel

The nerve center of a fighter aircraft was the instrument panel. Always conveniently in view for the pilot, the cluster of instruments provided information not only about the plane's performance but also about navigation and damage.

A pilot was required to become adept at quickly reading the instruments, scanning for any sign of trouble that would indicate an oil leak or other damage. Also, the flight instruments were essential when flying through heavy cloud cover or during night missions when the external frames of reference often were obscured.

Going under the Hood

During training, flight cadets would have to prove their familiarity with the instruments of flight by "going under the hood." The specially designed trainer aircraft would feature heavy canvas curtains around the canopy that could be drawn closed, to shut the young pilot off from the world.

During normal flight the visible horizon was the most common reference for a pilot, and the forces acting on his body were the most accurate situational gauges of all. When flying by instruments, all this was thrown away. Common sense had to be abandoned to the instruments because a pilot's physical sensations could belie reality. A pilot's body might feel that it is leaning, but the turn-and-bank indicator indicates upright flight.

During flight with an instructor, the pilot would practice "unusual attitudes." The flight instructor would take control of the plane, jerking through every imaginable maneuver—spins, tight breaks, inverted flight—while the cadet would flop around the cockpit like a ragdoll. Then the instructor would turn control over to the confused pilot, who had nothing but instruments to make sense out of his body's queasy, confusing sensations. Was the plane inverted? In a steep dive? It was a nightmarish exercise in insecurity, forcing the cadet to ignore his senses and allow the instruments to interpret the data for him. He had to trust the cold, impartial dials rather than his own sensations as he corrected the flight and made the plane fly straight, level, and calm again.

The Cockpits in Aces Over Europe

The cockpits of the various planes in *Aces Over Europe* were developed from photographs of actual planes' interiors. Turn to the various views and you will see control linkages, structural supports, headrests, and other details. Looking left and right at the fuselage and other equipment will give you a feel for just how sparse these cockpits were, providing no creature comforts and only those controls vital for the pilot.

Although the instrument panels have been adapted from the original planes, they have been modified to provided a uniform set of instruments to aid you in flying the craft. Each plane provides you with the same basic set of instruments, the most notable exception being the twin-engine gauges found in the P-38 Lightning, the de Havilland Mosquito, and the Me-262.

The Instruments in Aces Over Europe

It would be hard to rate the instruments you will use in order of importance, because in various situations, different instruments will be essential to your successful completion of a mission.

The altimeter measures the height of your plane above ground level. This instrument functions by monitoring the changes in the atmospheric pressure as the altitude changes. In an actual airplane, the altitude is generally measured from sea level, meaning that your landing strip may be at an altitude of several hundred feet. To facilitate more convenient flying, the altimeter

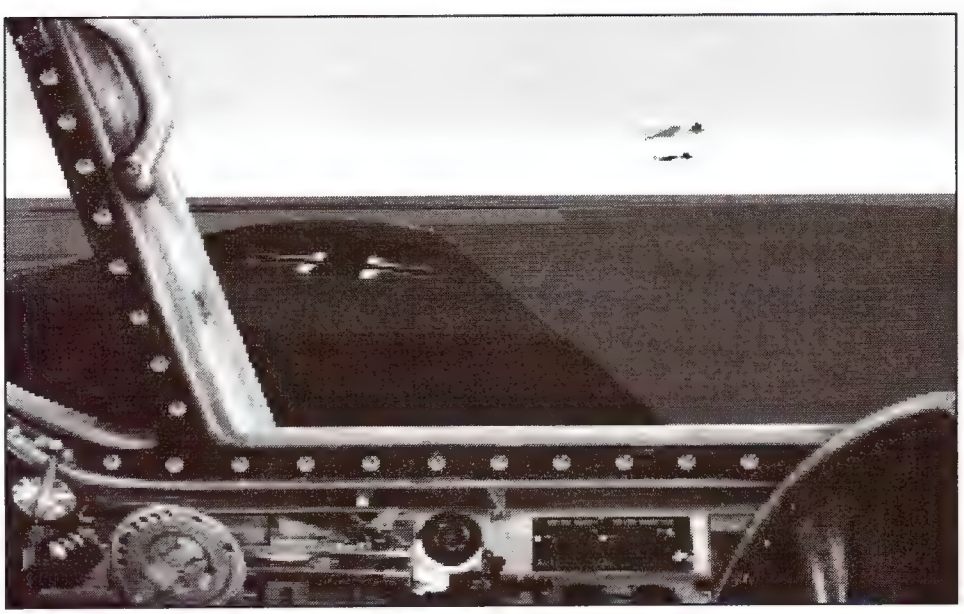


Figure 6-2

Looking right in a FW-190D in *Aces Over Europe*

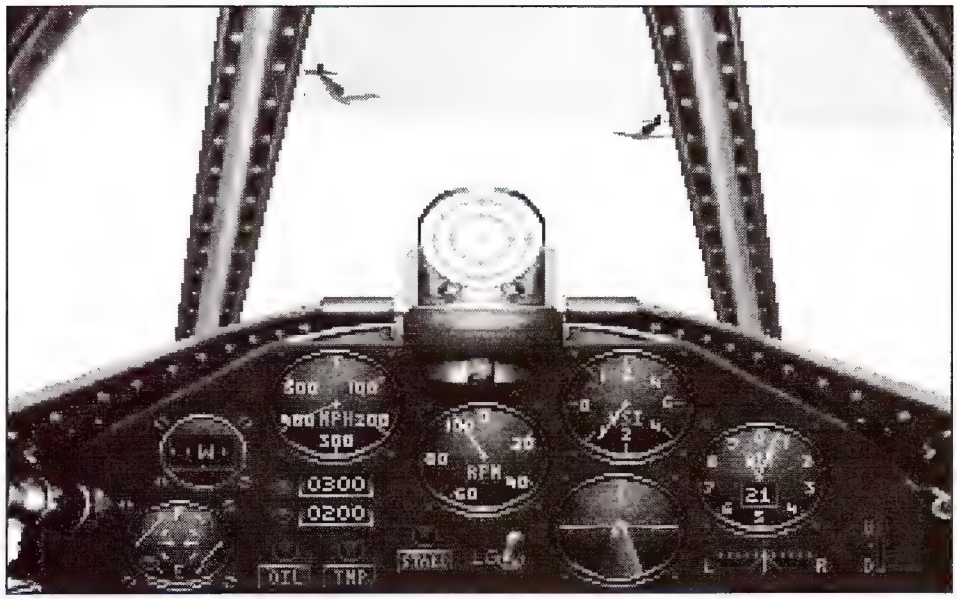


Figure 6-3

The instrument panel of a Spitfire IX in *Aces Over Europe*

in *Aces Over Europe* is adjusted such that your landing field will always be at 0 feet, which will make your landings much more manageable.

To read the altimeter, you must pay attention to all three indicators. The long hand, much like the minute hand of a watch, rotates to indicate your altitude in tens of feet. The shorter sweep hand indicates hundreds of feet, while the numerical readout will display thousands of feet.

The airspeed indicator measures your speed in miles per hour. This is not a horizontal ground-speed indicator but rather tells you your absolute speed. (In a dive your ground speed may be quite low while your airspeed may be well over 500 mph!) The instrument figures speed by interpreting the pressure variations of the air your plane is flying through and adjusting for altitude and the corresponding loss of air density.

The vertical speed indicator (VSI) displays the speed with which your plane is climbing or diving. Level flight will indicate a 0 vertical speed, and the needle will point directly left. The gauge measures your change in altitude in thousands of feet per minute.

The bank indicator provides a visual indication of the degree of bank relative to the horizon that your plane is experiencing. The gauge is basically a visually modified level and is a logical advancement of the bank indicators found in WWI fighters, which were simply arced, level tubes filled with oil.

The tachometer, which monitors the RPM of your engine (or engines on a twin-engined plane), is certainly one of the most

important instruments in your cluster. The tachometer not only provides information concerning the speed of the engine, but it also provides damage information. A damaged engine will not be able to sustain the higher RPMs, and you will immediately notice a drop in the tachometer. If the drop becomes too great, then your engine is no longer functioning with combat capability and it is time to seriously consider turning back to base.

Paired with the tachometer are engine-temperature and oil-pressure warning lights. These will illuminate red if there is a problem. If your temperature light illuminates, throttle back your engine. If the oil-pressure light illuminates, it usually indicates damage to your cooling and lubrication system, which is very serious. Immediately throttle back your engine, and consider returning to base before you damage your engine.

The fuel gauge features two needles. The left one indicates the fuel remaining in your main, internal fuel tank. The right needle indicates fuel in your external tank and will always be used first. If you are not flying with an external fuel tank, the right needle will rest on the empty indicator. A fuel warning light will illuminate at the bottom left of the gauge if you are dangerously low on fuel. Do not disregard this message and immediately break away from your attack and return to base. You might also consider flying at low attitude so that you can execute an emergency landing if your engines sputter out.

The stall warning light illuminates to indicate that your airspeed is dropping below the level at which your wings can provide lift. When you see this light blink on, immediately level out your plane, increase throttle, or begin a shallow dive to restore sufficient airspeed to regain flight control.

You also have a rudder gauge in which a sliding wedge will indicate to what degree your rudder is applied.

Defensive Factors

In WWI, pilot armor consisted of a pilot sitting on his helmet or a stove lid to protect him from unexpected bullets from below. With the advanced weaponry of WWII, this form of protection was hardly sufficient. In the first years of the war, pilot and plane defensive measures were minimal to nonexistent. Armor plating a plane to protect it from a barrage of close-range, machine-gun fire was an obvious impossibility, and so the dictum of the moment was "a good defense is a strong offense." Instead of turning

towards armor, the designers attempted to pack as much firepower into the planes as possible—figuring that a first kill was all the protection a good pilot needed.

Self-Sealing Fuel Tanks

Perhaps the most vulnerable area of the plane—besides the pilot—was the fuel tank. The Japanese in the Pacific theater learned the lesson that a well-placed shot into a Zero's fuel tank caused the plane to explode, taking out not only a fighter plane but a skilled pilot as well. The fuel did not necessarily explode inside the fuel tank but instead caught fire as it leaked out. The solution, already in place in the European theater, was the installation of self-sealing fuel tanks.

Basically, the entire exterior surface of the fuel tank was coated with an uncured natural-rubber paste. When a bullet struck the tank, it passed through the rubber and into the tank. As the fuel started to leak from the hole, it initiated a chemical reaction with the rubber paste, causing it to swell and plug the hole.

Once fighters were fitted with external fuel tanks to extend their useful escort range, there was concern about the risk of fire from an exploding tank. The droptanks, which were externally mounted, were not coated with the self-sealing rubber and were vulnerable to an enemy's bullet.

The USAAF conducted tests on the droptanks and found that even when struck with an explosive bullet, the burning fuel would fall away from the fighter before any damage could be done. The tanks themselves did not fragment like shrapnel but instead broke apart in large pieces, falling harmlessly away.

In *Aces Over Europe*, the droptank is not so docile when shot. It will explode and cause damage to the underside of your aircraft as it falls away.

Armor

Perhaps the most basic protection for a pilot in a single-engined fighter was the engine itself. Although bullets striking the engine might cause an oil leak or other serious damage to the plane, the engine did provide excellent protection for the pilot from frontal attacks.

The glass of the plane's canopy, though not strictly bulletproof, was generally thick glass (sometimes even 5 centimeters thick) and provided good protection from glancing, high-deflection bullets.

The pilot was also protected by strategically placed armor plating and deflection shielding. The armor plates were generally steel placed behind the pilot's head, underneath the pilot, and within the sides of the cockpit. The plates were designed to slow or stop direct hits from average-sized shells. In addition, the underside of the engine cowling often featured thinner deflection shielding. While not thick enough to stop a direct hit, the shielding could turn away bullets striking from a deep angle.

Vulnerability

All planes, no matter how heavily armored, were vulnerable to the machine-gun and cannon fire of another plane. There were many systems on a plane that were essential to the continued performance of a plane and were also vulnerable targets.

General fuselage hits are perhaps the least critical. A stressed-skin fuselage can absorb quite an amount of damage before the structural strength is seriously compromised. On the other hand, the engine, oil system, and fuel systems are the most vulnerable. In a study conducted by the U.S. Navy in 1944, those particular areas proved to be the most vulnerable to a critical hit. An engine hit meant that the plane was lost over 60 percent of the time, while a fuel hit (even with self-sealing tanks) or oil system hit chalked up over an 80 percent loss rate. Of course, the most deadly hits of all were to the pilot himself.

Bailing Out

If a pilot knew that his plane was going down, his last means of survival was to bail out. An emergency control in the cockpit would allow the pilot to disengage his canopy, and the force of the wind helped him leap from the airplane.

Serving as his seat cushion while in the plane, his parachute would open when he pulled the rip cord. In *Aces Over Europe*, you can bail out by pressing Ctrl-B. Be sure that you have at least a few thousand feet of altitude for your parachute to open effectively.

The Fighters of Aces Over Europe

Aces Over Europe will allow you the opportunity to fly 16 different planes for the USAAF, RAF, and the Luftwaffe. The capabilities range from that of a high-performance fighter (the

P-51D) to the first jet fighter (the Me-262) to the unarmed Arado 234B jet bomber. Each plane possesses unique abilities, armaments, and restrictions. Perhaps one of the most enjoyable aspects of *Aces Over Europe* is to sample the various planes, getting a sense for which plane feels right in a particular situation.

All planes project a certain personality on paper, and a table of numbers can tell you quite a bit about the performance and abilities of a plane. Numbers, however, are only objective labels. A plane is merely a complicated extension of the pilot. The statistics which follow—as well as those found in the Dynamix manual and in the game itself—will provide you with the facts and figures but cannot provide you with the feel of the airplane.

Take the Focke-Wulf 190 as an example. As we read in Chapter 3, pilots felt that the plane handled like a bus and generally preferred the Me-109. Look at the numbers and you will see a different story. The Focke-Wulf, especially the later versions, was far and away the better performer. Then why this discrepancy? Luftwaffe pilots simply felt more in control of the Messerschmitt.

It is that type of subjective evaluation that only you can provide. Fly the planes, trying different planes for different missions, and soon you will find yourself preferring one over the other—not because of a list of facts and figures but because it just feels right. You might consider purchasing a small spiral notebook to keep as your flight log. Record your missions and the planes that you flew. Be sure to record your observations about the abilities (or lack of abilities) of each plane you fly. You will begin to develop a dictionary of preferred planes and flight techniques. Keep your log handy, and don't be afraid to change you mind as your level of skill increases.

The Aces Over Europe Vehicle Database

Aces Over Europe provides an excellent database within the game itself that allows you to view and learn about the multitude of vehicles you will fly or encounter during you missions. Select View Vehicles to access the database from the main menu screen.

You can view information about the planes, ships, and vehicles in the *Aces Over Europe* world by selecting the option in the View Which menu. You will then have the opportunity to select which force you wish to examine.

B-17G FLYING FORTRESS
334th Bomb Squadron
The standard heavy bomber employed by the 8th Air Force. The B-17 was a durable, heavily armed four engined bomber capable of ranging across Europe to bomb strategic targets deep within Nazi Germany.
STATS
PREVIOUS
NEXT
CONTINUE

Figure 6-4

The View Vehicle screen displaying an Allied B-17G bomber

The primary view screen will provide a short introduction to the vehicle as well as controls that will allow you to rotate the view and provide the ability to zoom in or out. When viewing Airplanes, you may click on the Squadron bar to bring up a list of squadrons represented in the game. Selecting a squadron will change the paint scheme and markings of the plane. The Stats button will provide a facts-and-figures overview of the vehicle. When you are viewing the Ships and Vehicles categories, the statistics are brief (as opposed to the detailed full screen of stats for the aircraft) but will provide important information about the armor and defensive capabilities of the vehicle. The Airplanes Statistics screen will provide you with the all-important maneuverability, firepower, and durability ratings that will give you an indication as to how a certain plane will perform within the simulation.

The Planes of the USAAF

You have the ability to fly three planes for the United States Army Air Forces: the P-51D Mustang, the P-38J Lightning, and the P-47D Thunderbolt. All of the USAAF planes are highly durable, second-generation fighter aircraft, and each has the ability to take on the best that the Luftwaffe can throw out.

Republic P-47D Thunderbolt

The P-47 was designed in 1940 to be a plane on equal terms with the best fighters of Europe. Throughout its design gestation,

Table 6-2 Republic P-47D Thunderbolt

LENGTH	36 ft	TOP SPEED	420 mph
WINGSPAN	40 ft 9 in	LANDING SPEED	100 mph
WEIGHT EMPTY	9900 pounds	CLIMB RATE	2750 ft/min

several engine combinations were tried, but it was not until the spring of 1943 that the P-47 first saw combat action.

A unique feature of the P-47 was the internal turbo-supercharger assembly. To maintain proper weight and balance, the supercharger had to be fitted in the fuselage behind the pilot. The air intake for the carburetor was in the plane's cowl and had to be ducted back some 20 feet to the supercharger assembly, then another 20 feet forward to the engine. Finally, the exhaust gas (which was utilized to spin the turbine fan) had to be ducted back another 20 feet through flexible piping that could expand and contract under the extreme heat conditions. The massive amount of interior ducting lead to the rather bulbous, unique shape of the fighter.

The P-47D was powered by a Pratt & Whitney Double-Wasp 18-cylinder, air-cooled radial engine rated at 2535 horsepower. This unique engine consisted essentially of two, nine-cylinder radials sandwiched together to create a massively powerful engine that could withstand punishing amounts of damage.

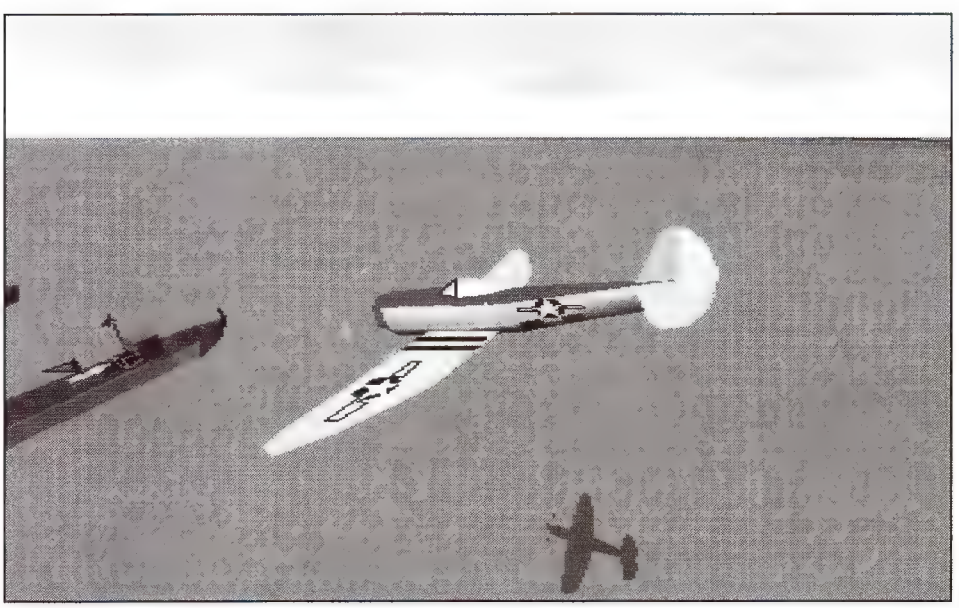


Figure 6-5

Republic P-47D Thunderbolt

The canopy of the P-47D featured a unique plastic bubble that afforded the pilot unparalleled visibility, especially to the rear. To protect the pilot, bulletproof glass was fitted in front and the pilot's seat back and headrest were reinforced with steel armor.

The P-47D carried eight of the standard .50-caliber machine guns mounted in two banks of four. The P-47D was most known for its ground-attack and bombing capabilities and could be heavily loaded with ground-attack ordnance of up to 3000 pounds of bombs for attack missions. The P-47D could also carry a single 500-pound bomb with a loadout of 10 rockets that were fired in pairs when outfitted for strike capability.

In the armament table below and the ones that follow, the ammunition listed for the machine guns indicates the number of rounds loaded for each gun. In the case of the P-47D, four guns are linked together into a bank, each firing its rounds simultaneously.

In *Aces Over Europe* the P-47D flies predictably if not spectacularly. In a tight bank, the plane responds reasonably well but begins to snap as the inertia is built up. Even at full throttle, the plane struggles with an Immelmann, nearly falling to stall speed at the top of the loop. The plane turns solidly but never tight enough to risk a blackout or to turn inside the Luftwaffe's planes.

Perhaps the P-47's greatest strength lies in its ability to dive with smooth control until the speed reaches 600 mph, at which point the airframe begins to vibrate violently. Carefully maintaining a dive speed of approximately 500 mph by throttling back and adjusting the flaps will allow you to control your dive on target.

The P-47 does not feature dive breaks. If you deploy your flaps at an excessive speed, they will become damaged.

Table 6-3 P-47D Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
.50-caliber Machine Gun	4	425/gun	
1000-pound Bombs	3		Attack Loadout
500-pound Bombs	1		Strike Loadout
Rockets		10	Strike Loadout

Table 6-4 Lockheed P-38J Lightning

LENGTH	37 ft 10 in	TOP SPEED	414 mph
WINGSPAN	52 ft	LANDING SPEED	85 mph
WEIGHT EMPTY	12,780 pounds	CLIMB RATE	3200 ft/min

When attempting to take off with a full load of bombs, the P-47 truly feels every ounce of its 13,000 pounds. Pull back slowly at full throttle and retract the landing gear as soon as it is safe but climb slowly to avoid stalling.

Lockheed P-38J Lightning

The P-38 was initially designed in 1937 as a high-altitude interception fighter and was Lockheed's first attempt at creating a military aircraft. In the prototype's inaugural flight of early 1939, the plane crashed at the end of a record-setting transcontinental California–to–New York flight. The P-38 was the first American fighter that could be considered an equal to the Me-109 or the Spitfire. The twin-boom design was incorporated to make room for the twin turbo-superchargers as well as the landing gear. The fact that the plane was designed to fly with twin-engines but could fly with only a single engine made it a favorite of pilots.

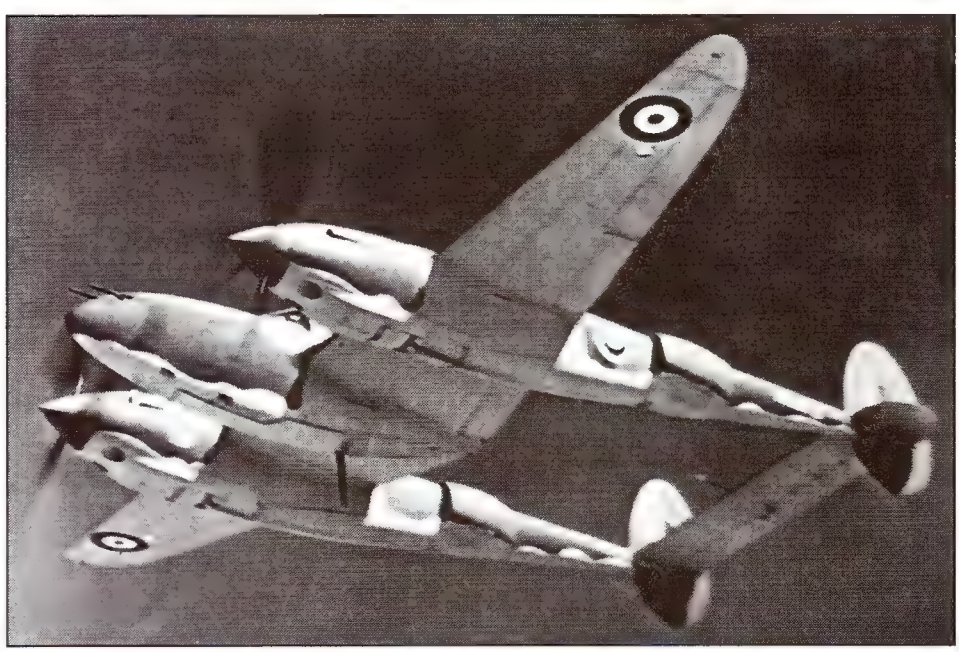


Photo 6-5

Lockheed P-38 Lightning sporting RAF markings

The P-38's propellers rotated in opposite directions, eliminating the drifting yaw problem associated with many twin-engine planes. In addition, the contra-rotation of the propeller meant that the P-38 did not spin when it stalled, allowing for easier pilot recovery. The plane could perform with reasonable dexterity, able to outroll a Bf-109 through high-speed maneuvers. For the pilot the high, bubble canopy provided excellent visibility, especially to the rear. The P-38J provided a flat front windscreen—as opposed to a curved windscreen on earlier models—that cut down on the distortion and glare. The large wings, however, made left and right spotting difficult.

The P-38J was powered by twin Allison V-1750, 12-cylinder liquid-cooled engines delivering 1425 horsepower each. Each engine was supplied fuel from three independent, self-sealing tanks. Four of the six fuel tanks were interconnected, allowing fuel to be delivered to either engine.

Perhaps the most significant problem encountered with flying the P-38 was an extreme susceptibility to compressibility. During high-speed dives, the controls would become frozen, the pilot unable to budge them until the plane plummeted into the heavier air at low altitudes. The twin-tailed airframe would vibrate, creating shock waves which could tear the plane's airframe apart.

Compared to the P-47, the P-38 in *Aces Over Europe* feels like a much more nimble plane even though it gives up nearly 3000 pounds in weight. The turns are smooth and responsive, and the plane can break tight enough to get a good bead on an FW-190 if it begins with the advantage. The P-38, like the P-47, struggles even at full throttle with no bomb load to perform an Immelmann without dropping too much speed.

Table 6-5 P-38J Offensive Capabilities

Weapon	Number	Ammunition	Note
.50-caliber Machine Gun	4	500/gun	
20-mm Cannon	1	150	
1000-pound Bombs	2		Strike Loadout
500-pound Bombs	2		Attack Loadout
Rockets		10	Attack Loadout

Table 6-6 North American P-51D Mustang

LENGTH	32 ft 3 in	TOP SPEED	437 mph
WINGSPAN	37 ft	LANDING SPEED	90 mph
WEIGHT EMPTY	7125 pounds	CLIMB RATE	3,125 ft/min

The P-38 is equipped with dive brakes that slow the descent and maintain a speed below which compressibility becomes a serious problem during a high-speed dive.

Its twin-engines provide more than enough thrust for an easy takeoff, even when loaded with 2000 pounds of bombs.

Of all the planes you can fly in *Aces Over Europe*, the P-38J is perhaps the most forgiving to land. Its wide wingspan and dispersed center of gravity make it extremely stable and controllable on a landing approach.

North American P-51D Mustang

The North American P-51D was easily the best American fighter of the war and arguably the best overall fighter, possessing excellent all-around abilities. The P-51 performed better than, or at least comparable to, all of the other fighters, Allied and Luftwaffe alike. The clean lines of the plane along with extensive design improvements made it the height of fighter design during WWII.

Originally designed by North American for the RAF in 1940, the P-51 owed much of its early development trials to the Curtiss

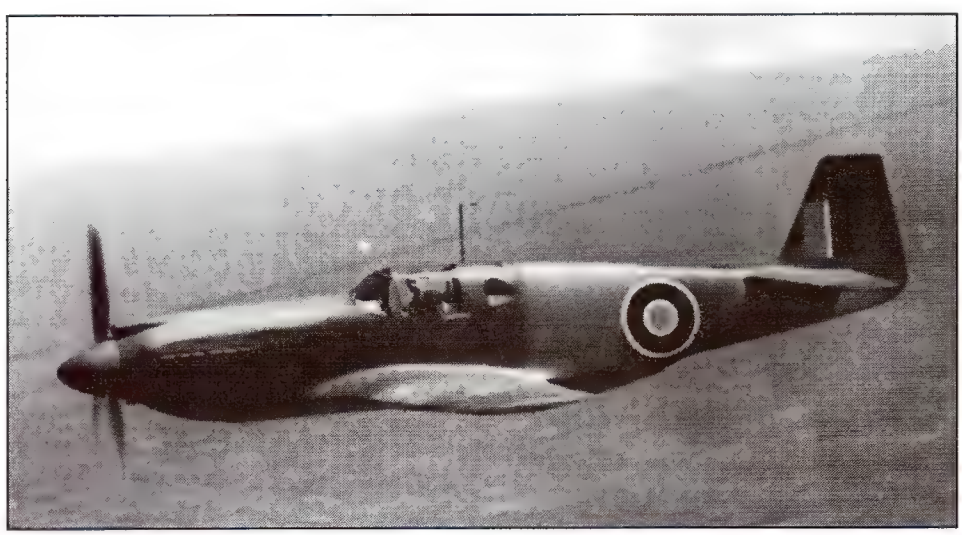


Photo 6-6

An earlier version of North American Mustang, this one flying for the RAF

P-40 Warhawk, and Curtiss turned over much of its technical data to North American to expedite the design process. When the P-51 reached production in 1941, the USAAF paid it little attention and the first deployment of the plane fell to ground support duties for the RAF. The RAF, whose Spitfire was generally regarded as the best fighter in the world, began to realize that the P-51 had similar potential.

In 1942 Major Thomas Hitchcock, the USAAF's military attaché in London, noted that the P-51 was "one of the best, if not the best fighter airframe that has been developed." He advised that the P-51 airframe be melded with the famed Rolls-Royce Merlin engine (which performed admirably in the Spitfire) to produce a high-altitude intercept fighter of uncommon abilities.

The Merlin engine was a 12-cylinder, liquid-cooled in-line engine that generated 1510 horsepower. The Merlin was an extremely high-performance engine, squeezing the maximum horsepower out of the minimum weight, and was designed to be easily maintained by ground crews.

Perhaps the most significant feature of the P-51 Mustang was the implementation of a laminar flow wing. This type of wing was manufactured with an extremely smooth, polished finish to reduce atmospheric drag. The surface could not have any waves or puckers which varied over .0001 of an inch per square inch of surface area. This high degree of polish allowed the Mustang to produce greater speed from less horsepower. The effect was reduced, however, when debris or insects accumulated on the leading edge of the wing.

In *Aces Over Europe* the P-51D feels tight and nimble at nearly all speeds and can turn inside of any aircraft. The plane is smooth and responds with very little lag to any control movement. When performing a high-stress maneuver such as an Immelmann, the Mustang will lose speed but not enough to stall.

During dives, the Mustang performs well up to 450 mph. Then the effects of compressibility come on fast, jerking the airframe around. Control is very sluggish; however, if corrective action is taken immediately by pulling the stick back, then chances are that you can pull out. If you hesitate, the lightweight Mustang will suffer serious damage in a matter of seconds, forcing you to attempt a very risky bailout that in all likelihood will prove fatal.

Table 6-7 P-51D Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
.50-caliber Machine Gun	4	313/gun	
.50-caliber Machine Gun	2	313/gun	
1000-pound Bombs	2		Attack Loadout
Rockets		8	Strike Loadout

The P-51D is an extremely nimble aircraft, and the powerful Merlin engine allows rapid acceleration from escort speed to attack speed. During a dive, a P-51 can even outperform and eventually catch up with the jet-powered Me-262.

The superior agility of this plane coupled with the six machine guns, each with significant stores of ammunition, makes the P-51 extremely capable of taking on multiple opponents. Turning inside of an enemy and laying in a close-range, low deflection shot is your best bet for a kill. The maneuverability of this plane makes it especially effective to get out from under an enemy's bullet.

The P-51 is, however, one of the most difficult and touchy aircraft to land in *Aces Over Europe*. Special care must be taken to maintain a straight landing approach and the proper amount of speed to avoid a premature and potentially fatal stall.

The Planes of the RAF

You have the opportunity to fly six Royal Air Force planes from the quirky, twin-engined, wood-frame Mosquito to the powerful Tempest to the definitive plane for the RAF, the Spitfire. Unlike their USAAF counterparts who focused on a universal design, the RAF designers created planes that differed widely in ability and function—recognizing the special nature of the RAF fighters.

Hawker Typhoon

The Hawker Typhoon was first flown as a prototype in early 1940, but further testing was halted after Hitler's successful invasion of France. For the next year, the Hawker company concentrated its energies on producing the proven Hurricane. It was not until May 1941 when the first production Typhoon flew.

Table 6-8 Hawker Typhoon

LENGTH	31 ft 11 in	TOP SPEED	422 mph
WINGSPAN	41 ft 7 in	LANDING SPEED	95 mph
WEIGHT EMPTY	8840 pounds	CLIMB RATE	3900 ft/min

Although classified as a fighter-bomber, the Typhoon never met great success as an air-to-air fighter because its maneuverability and durability could not quite equal those of the Luftwaffe's Bf-109s and FW-190s.

The Typhoon did perform admirably, however, as a ground-attack fighter, and its armament was perfectly designed for tank busting. The four wing-mounted French-licensed Hispano 20-mm cannons, (coupled with the ability to carry 16 underwing rockets) enabled the Typhoon to deliver an offensive punch some compared to a broadside barrage from a naval cruiser.

The Typhoon was powered with a 2200-horsepower Napier Sabre IIA, 24-cylinder liquid-cooled in-line engine. The Sabre gave the Typhoon great climbing ability as well as a slight speed advantage over the Luftwaffe planes, allowing the pilot a chance to flee should an encounter turn ugly.

The odd housing beneath the engine was a low-velocity duct that housed the radiator, oil cooler, and engine intake, allowing for a clean, aerodynamic, topside profile.

In *Aces Over Europe* the Typhoon is surprisingly nimble when initiating a maneuver but requires quite a bit of anticipation to

Photo 6-7

A wing of RAF Typhoons flying over England

Table 6-9 Typhoon Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
20-mm Cannon	2	140/gun	
20-mm Cannon	2	140/gun	
1000-pound Bombs	2		Attack Loadout
Rockets		16	Strike Loadout

finish cleanly. The plane turns well but not nearly tightly enough to cut inside during a tight-quarters dogfight.

The powerful Sabre engine provides more than enough horsepower to attempt an Immelmann, finishing nearly 100 mph faster than the P-51D. This makes looping maneuvers an extremely good choice either to evade an impending attack or to attempt to engage an enemy when the mission situation forces you to continue a dogfight.

In a dive, the Typhoon begins to show signs of stress at approximately 500 mph. Though it is not as quick to damage as the Mustang, you should pull up as soon as possible to avoid serious airframe damage.

Landing in a Typhoon is straightforward, and the plane is forgiving enough to allow last-minute adjustments before touching down.

The firepower of this plane is what truly sets it apart. When configured for a Strike mission, the 16 rockets fired in pairs will provide 8 shots of deadly power and the 4 cannons when fired in unison are enough to take out nearly any vehicle on a single pass (as well as many naval and fortified targets).

Hawker Tempest

The Hawker Tempest is essentially a further development of the Typhoon, though design progressed concurrently. As the Hawker company put forward plans for the Typhoon, one variation called

Table 6-10 Hawker Tempest

LENGTH	33 ft 8 in	TOP SPEED	442 mph
WINGSPAN	41 ft	LANDING SPEED	95 mph
WEIGHT EMPTY	8969 pounds	CLIMB RATE	3360 ft/min

Figure 6-6

The Hawker Tempest in *Aces Over Europe*

for the use of elliptical, clipped wings. This design evolved into the Tempest and was first produced in June of 1943.

The elliptical wing design provided the Tempest with slightly better agility than the Typhoon, but the thinner wing required that the wing-mounted fuel tanks of the Typhoon be moved to the fuselage. The fuselage had to be strengthened, and to compensate for the change in balance it had to elongated. Thus the Tempest ended up just slightly heavier than the Typhoon.

The plane was powered by the same Napier Sabre engine, but the slight increase in weight and balance made the climbing performance suffer. It was armed in the same manner as the Typhoon and packed an identical offensive punch.

While the Tempest in *Aces Over Europe* does not initiate maneuvers as quickly as the Typhoon, it is a more nimble performer and able to truncate a maneuver with much more certainty. The turn rate is superior to that of the Typhoon but still not up to the Luftwaffe opponents it faces in the air.

The Tempest does excel in the top speed category, able to outrun and outrace nearly any plane—with the notable exception of the Me-262. This speed when applied to a maneuver such as an Immelmann will allow you to finish your loop and roll with a speed of nearly 225 mph—as much as 100 mph faster than that of your Luftwaffe adversaries. Initiating an Immelmann after a high-speed dive, you can complete the maneuver carrying nearly 300 mph of airspeed.

Table 6-11 Tempest Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
20-mm Cannon	2	140/gun	
20-mm Cannon	2	140/gun	
1000-pound Bombs	2		Attack Loadout
Rockets		16	Strike Loadout

The Tempest does not experience problems in dives until well over 500 mph; and although it will experience compressibility symptoms, steady back pressure on the stick will generally pull the plane back to level flight.

While the landing speed of the Tempest is 5 mph higher than that of the Typhoon, its low-speed stability is superior, nearly matching that of the P-38 Lightning.

Supermarine Spitfire

The Supermarine Spitfire and the P-51 Mustang were easily the most recognizable and romanticized of all the fighter aircraft of WWII. First constructed in 1936, the Spitfire evolved from a racing seaplane and boasted a top speed of 342 mph, making it the fastest military aircraft in the world.

The Spitfire remained relatively consistent to its original design, improving its performance until it reached the level of being the best fighter in the war until the development of the Merlin-powered Mustang. Its unique, elliptical wing was the thinnest of all the fighters and provided nimble performance throughout the entire speed spectrum. The Spitfire was the first stressed-skin

Table 6-12 Supermarine Spitfire (IX & XIV)

LENGTH	32 ft 2 in	TOP SPEED	416 mph (IX) 439 mph (XIV)
WINGSPAN	36 ft 10 in	LANDING SPEED	65 mph (IX) 75 mph (XIV)
WEIGHT EMPTY	5816 pounds (IX) 6576 pounds (XIV)	CLIMB RATE	3950 ft/min (IX) 4580 ft/min (XIV)

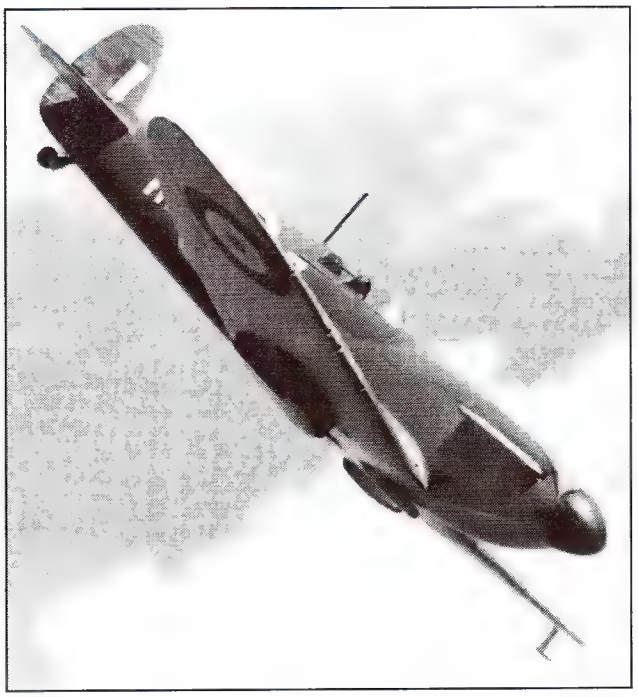


Photo 6-8

A Spitfire IX in a steep dive

fighter to be mass-produced for the RAF and proved to be a difficult plane to maintain in the early years. Later in the war as mechanics grew familiar with the plane and the constant improvements to the powerplant meant more reliability and ease of repair, the Spitfire became a favorite of ground crews as well as pilots.

The Spitfire IX was powered with a Rolls-Royce in-line Merlin engine, rated at 1650 horsepower. The engine, a variation on that found in the Mustang, allowed the lighter Spitfire to enjoy a phenomenal rate of climb and excellent speed at level flight. The XIV upped the ante by utilizing Rolls-Royce's Griffon engine—a 12-cylinder, two-stage, supercharged engine capable

Table 6-13a Spitfire IX Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
.303-caliber Machine Gun	4	33/gun	
20-mm Cannon	2	200/gun	
500-pound Bombs	1		Strike Loadout
250-pound Bombs	2		Attack Loadout

Table 6-13b Spitfire XIV Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
.303-caliber Machine Gun	4	300/gun	
20-mm Cannon	2	200/gun	
500-pound Bombs	2		Attack Loadout
Rockets		8	Strike Loadout

of producing just over 2000 horsepower. The XIV also added a five-blade propeller (as opposed to the four-blade prop found on the IX) to increase the performance even further.

In *Aces Over Europe* both the Spitfire IX and XIV seem to leap into the air on takeoff and are able to become airborne less than 5-seconds after they begin rolling down the tarmac. Instantly, they are responsive and alert, snapping promptly to the pilots' control.

The Spitfire IX is an agile performer, able to match or to better the Bf-109 and FW-190 in a tight turn. Performing an Immelmann or loop from top speed will still leave the plane traveling at nearly 200 mph after the maneuver. During a steep dive, the plane begins to shake at around 450 mph, but the thin wing virtually eliminates compressibility problems so that control is available at all times.

The IX suffers from extremely poor rear visibility, because the canopy does not extend above the swept fuselage in the rear. It has a very low landing speed, giving the pilot ample time for corrections before the plane stalls.

The XIV performs a shade better than the IX—it's able to perform a tighter turn. The XIV can complete an Immelmann while still maintaining an airspeed well over 200 mph. In a steep dive, the Mark XIV begins to shudder at around 500 mph. Like the IX, however, it does not experience compressibility problems and rarely develops dive speed in excess of 550 mph.

The XIV features an improved bubble canopy that provides excellent rear visibility.

de Havilland Mosquito

The de Havilland Mosquito was originally designed in 1938 as a light bomber with a defensive emphasis on speed rather than

Table 6-14 de Havilland Mosquito

LENGTH	40 ft 6 in	TOP SPEED	425 mph
WINGSPAN	54 ft 2 in	LANDING SPEED	100 mph
WEIGHT EMPTY	16,631 pounds	CLIMB RATE	1870 ft/min

firepower. The plane—which first flew in November 1940—was constructed of a wood laminate for economy and increased production speed.

The speed of the twin-engined two-seater was sufficient enough to outrun most interception attempts, and it became a dangerous weapon for pinpoint, low-altitude bombing. The Mosquitoes could deliver their bomb load and turn home before fighters could scramble to defend against them.

The Mosquito VI and XVIII were both powered by twin Rolls-Royce Merlin engines rated at 1635 horsepower each. While the rate of climb and maneuverability were to be expected from a large, somewhat clumsy plane, the clean wing design and the powerful engines provided level flight in excess of 400 mph.

The Mosquito VI was designed as a fighter–bomber, with the bombs fitted in the fuselage's bomb bay rather than under the wings. The VI was utilized primarily against shipping targets.

The XVIII featured a modified fuselage that housed a 57-mm antitank cannon, making the plane perfectly suited for tank busting and destroying fortified ground targets. The fuselage and engine cowlings were also heavily armored to protect against low-altitude defensive fire.

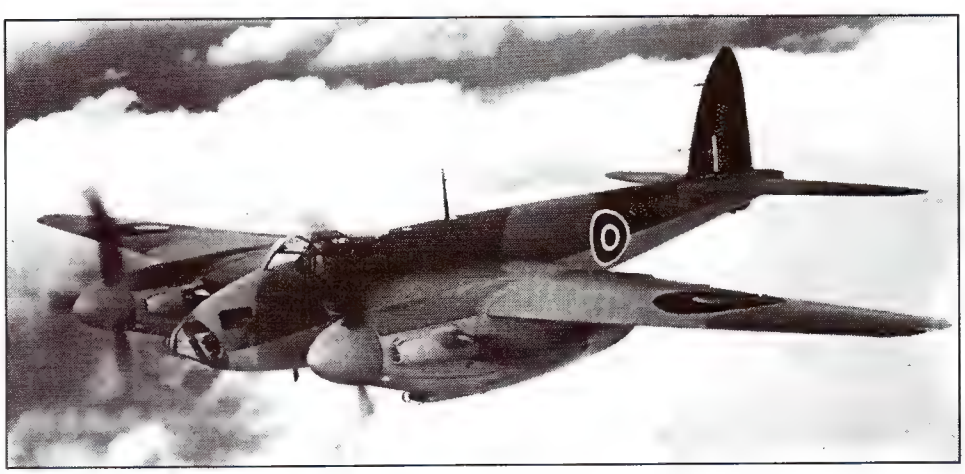


Photo 6-9

An RAF Mosquito skimming the clouds over northern Europe

Table 6-15a Mosquito XVIII Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
.303-caliber Machine Gun	4	1000/gun	
57-mm Cannon	1	22	
500-pound Bombs	2		Strike Loadout
Rockets		8	Attack Loadout

In *Aces Over Europe* the Mosquito responds to aileron control with remarkable quickness, but the plane truly shows its weight as a pilot attempts to fly through a maneuver. Care must be taken not to overcorrect the plane at a maneuver's completion. Turns are moderately tight but cause the plane to lose a significant amount of altitude. During roll maneuvers, the plane hesitates on the knife-edge, making the roll erratic rather than smooth.

The plane can perform Immelmanns reasonably well, although lacking the snap of the smaller fighters. Initiating such a maneuver from a level speed of 350 mph will conclude the maneuver with a speed just under 150 mph. In a steep dive, the airframe will begin to vibrate at 400 mph, but the plane does not experience compressibility problems.

The Mosquito VI and XVIII share similar flight characteristics across the board. For all practical purposes, the only true difference is in the armor and offensive capabilities of each.

Both Mosquito versions provide the pilot with poor forward visibility due to the width of the cockpit and the rather large instrument panel. Rear visibility is adequate but hampered by the canopy's many support spars.

Table 6-15b Mosquito VI Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
.303-caliber Machine Gun	4	1000/gun	
20-mm Cannon	4	200	
500-pound Bombs	4		Strike Loadout
1000-pound Bombs	2		Attack Loadout
Rockets		8	Attack Loadout

The Planes of the Luftwaffe

You have the opportunity to fly six Luftwaffe fighter planes as well as the unique and unarmed Arado jet bomber. The Luftwaffe's planes began the war with a clear technological and performance edge over the Allies, but by the late war planes such as the P-51D and Spitfire had closed that gap. Still, the Luftwaffe planes flown throughout 1944 and 1945 were solid performers, able to hold their own even against the new breed of Allied fighters. The ranks of the Luftwaffe were peppered with many aces, pilots whose skill and experience more than made up for any discrepancies between the combatants' planes. By the last months of the war, the Focke-Wulf 190D and the jet-powered Me-262 were among the best fighters in the war, but their further development into truly great fighters would come too late to save the struggling Luftwaffe.

Messerschmitt 109

The Messerschmitt Bf-109 was the most technologically advanced fighter at the start of the war and had already seen combat action in the Spanish Civil War. First produced in 1935, the low, mono-winged plane was a radical departure from the postWWI-era biplanes. The fuselage utilized stressed-skin construction and was manufactured in two halves, then joined. By the late war, the tail section of the plane was constructed of wood to preserve materials.

Because of its nimble touch and almost comfortable feel, the Bf-109 was a favorite of the Luftwaffe pilots. While well liked by the veteran pilots, however, the Bf-109 proved to be a difficult plane for inexperienced fliers to master. The light weight coupled with the closely spaced landing gear made the plane tricky to take off in and even trickier to land, causing many pilots to send the fighter into a graceful cartwheel across the landing strip.

Table 6-16 Messerschmitt Bf-109 (G & K)

LENGTH	29 ft 5 in	TOP SPEED	386 mph (G) 452 mph (K)
WINGSPAN	32 ft 6 in	LANDING SPEED	90 mph
WEIGHT EMPTY	5893 pounds	CLIMB RATE	3393 ft/min (G) 4880 ft/min (K)

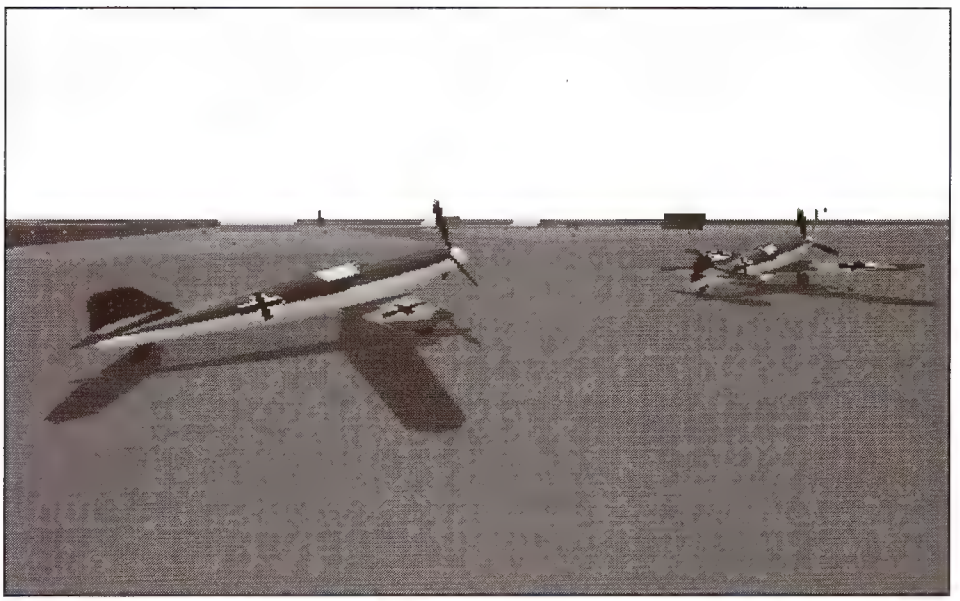


Figure 6-7

A pair of Bf-109Ks

The Bf-109 was powered with a Daimler-Benz, 12-cylinder, inverted vee in-line engine that developed 1475 horsepower in the Bf-109G and 2000 horsepower in the Bf-109K. The cockpit was cramped, and the canopy was constructed with plates of glass set into metal frames, making visibility poor and the environment slightly claustrophobic. Rear visibility was especially poor.

The Bf-109G was the standard fighter design from 1942 until the end of the war. It constantly evolved, appearing in no less than 14 minor variations. The G was a decent all-round fighter, but the limited armament—which left it outgunned when acting as a bomber interceptor—proved to be its main detraction. The addition of two wing-mounted cannons did much to improve the firepower, but the resulting loss in performance made the fighter easy prey for Allied escorts.

The Bf-109K was fitted with a larger version of the Daimler-Benz engine, generating 500 more horses than the G. The improved engine increased the plane's climbing performance as well as the top speed, but the added weight degraded the performance somewhat.

In *Aces Over Europe* the Bf-109G struggles slightly during take-off, and the initial climb must be shallow to avoid a stall. The more powerful Bf-109K has little power lifting into the air and feels solid at low altitude. Both planes feel bloated if attempting to take off with either bombs, external tanks, or extra cannons mounted.

Table 6-17a Bf-109G Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
13-mm Machine Gun	2	300/gun	
30-mm Cannon	1	60/gun	
30-mm Cannon	2	60/gun	External Guns
250-pound Bombs	2		Strike Loadout
Gr.21 Rockets	2		Strike Loadout
			Intercept Loadout

Turning behavior in the G is quick and responsive with very little counterpressure required to terminate a maneuver. The plane performs an Immelmann well, ending the maneuver with an airspeed of just over 200 mph. The plane dives well and will not experience turbulence problems until over 450 mph. Even though control becomes erratic, the plane will not succumb to compressibility and allows the pilot to make the necessary corrections with no need to panic.

The Bf-109K turns quickly but is not quite as nimble as the G. The more powerful engine, however, allows the plane to perform an Immelmann with sufficient determination to nearly cause pilot blackout. The K can dive at speeds up to 500 mph before experiencing any vibrations.

Perhaps the biggest drawback of the Bf-109 is the lack of offensive punch. The G is equipped with small-caliber machine guns which are virtually useless against bombers. Also, both versions suffer from a stingy allotment of ammo, forcing you to

Table 6-17b Bf-109K Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
15-mm Machine Gun	2	220/gun	
30-mm Cannon	1	60/gun	
250-pound Bombs	1		Strike Loadout
500-pound Bombs	1		Attack Loadout
Gr.21 Rockets	2		Intercept Loadout

plan your shots much more carefully. If you fly with the external guns mounted, they are fired by selecting the secondary cannon. All three 30-mm cannons will then fire simultaneously.

Focke-Wulf 190

While the Bf-109 entered the war as the Luftwaffe's premier fighter, that title soon fell to the Focke-Wulf 190. Although experienced pilots who had logged thousands of hours in their 109s were reluctant to embrace the new fighter, other pilots appreciated the plane's superior design and weaponry.

The plane blended together all of the desirable traits of a fighter: nimble performance, the ability to withstand damage (thanks to an air-cooled radial engine), and the power of a massive offensive punch. In bomber-intercept missions, the 190 seemed perfectly designed to execute head-on attacks against heavy Allied bombers. While the Bf-109 did not pack enough stopping power for this risky attack, the 190 with its multiple, integrated cannons could hope to take out a bomber with a single dead-on pass before diving away to avoid the defensive fire.

The 190A entered service in 1941, powered by a BMW 801D, 14-cylinder air-cooled radial engine delivering 1700 horsepower. The engine, which was more easily produced and maintained than the Luftwaffe's in-line engines, also provided excellent protection for the pilot during head-on attacks. The 2 × 7 layout of the cylinders meant that the engine could withstand an incredible amount of damage before shutting down completely.

In addition to the safety shield of the radial engine, the 190 employed a canopy that could be jettisoned by explosive bolts, making it far easier to open in an emergency than the hinged Bf-109 canopy.

Table 6-18 Focke-Wulf 190 Series

LENGTH	29 ft 4 in (A-8,F-8) 33 ft 5 in (D-9)	TOP SPEED	408 mph (A-8) 426 mph (D-9) 394 (F-8)
WINGSPAN	35 ft 5 in	LANDING SPEED	90 mph
WEIGHT EMPTY	7652 pounds (A-8) 7694 pounds (D-9) 7328 pounds (F-8)	CLIMB RATE	2350 ft/min (A-8) 3123 ft/min (D-9) 2111 ft/min

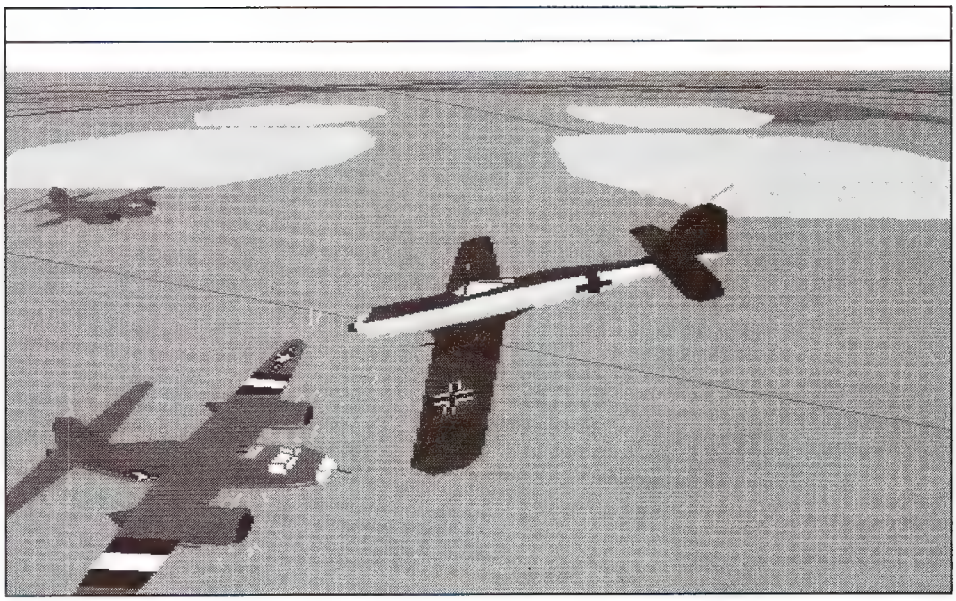


Figure 6-8

A Focke-Wulf 190A in action

The 190F was essentially the same plane as the A series but modified for ground-attack missions with extensive undercarriage armor plating to protect the pilot and the engine. Two of the plane's cannons were lost in order to keep the F series' weight down.

The 190D series replaced the radial engine with a 12-cylinder, Junkers Jumo 213A-1, liquid-cooled in-line engine rated at 2240 horsepower. To compensate for the longer engine, the cowling of the plane was extended and the area of the tail fin was enlarged. The D series was arguably one of the best fighters of the war and could give a hard battle to any plane that dared to challenge it.

In *Aces Over Europe* both the A-8 and D-9 take off easily while the F-8 struggles slightly under the extra weight of the armor. At low altitudes the planes all perform solidly, banking smoothly and allowing full pilot control.

The 190A performs very well, though the Bf-109 can outrun it slightly. The plane tends to lag as you finish a maneuver, so back pressure is generally needed on the stick. In an Immelmann, the 190A loses substantial speed and finishes at the top at just over 150 mph from a top-speed initiation. In a dive the plane will rattle at speeds over 500 mph, but it will not dive faster than 525 mph and does not experience compressibility problems.

The 190F with the added weight of the armor shielding is slightly less nimble than the 190A and finishes an Immelmann

Table 6-19 Focke-Wulf 190 Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
13-mm Machine Gun	2	475/gun	(A-8), (F-8), (D-9)
20-mm Cannon	4	150/gun	(A-8)
20-mm Cannon	2	250/gun	(F-8), (D-9)
20-mm Cannon	4	150/gun	External Guns (A-8), (F-8)
500-kilogram Bombs	1		Strike Loadout (A-8), (F-8), (D-9)
250-kilogram Bombs	1		Attack Loadout (D-9)
100-kilogram Bombs	4		Attack Loadout (F-8)
50-kilogram Bombs	4		Strike Loadout (A-8), (F-8)
			Attack Loadout (A-8)
Gr.21 Rockets		2	Attack Loadout (A-8), (F-8)
			Intercept Loadout(A-8), (F-8)

with a speed just over 100 mph. In all other regards the performance of the two planes is comparable, although the F series tends to lose more altitude in a tight turn.

The 190D is easily one of the best fighter in *Aces Over Europe,* providing excellent, tight, turning ability, turning inside of every plane with the exception of the P-51D (which can turn only a fraction tighter). It performs aerobatics with tight precision and snaps instantly to the pilot's commands. In an Immelmann, the finishing speed is just under 200 mph, but the loop is sufficiently tight to gain an advantage over an opponent.

In a steep dive, the plane begins to falter under the turbulence at 525 mph and will show signs of compressibility at speeds nearing 600 mph—just as the pilot begins to black out. The airframe cannot handle the violent twisting of the compressibility phenomenon for more than a few seconds.

All of the 190 planes possess massive firepower, and the addition of external guns on the A and F series will give the plane more power than almost any other plane, Luftwaffe or Allied.

Table 6-20 Messerschmitt 262

LENGTH	34 ft 9 in	TOP SPEED	540 mph
WINGSPAN	40 ft 11 in	LANDING SPEED	140 mph
WEIGHT EMPTY	8378 pounds	CLIMB RATE	3937 ft/min

Messerschmitt 262

The Me-262 entered service in 1944 as the world's first operational jet aircraft. The twin-engined plane, through a marvel of engineering, came too late to change the tables for the Luftwaffe. Hitler mistakenly misinterpreted a memo about the plane having fighter-bomber capabilities and insisted that the lightning-quick plane be put to use bombing England as the Allies prepared for the invasion.

Hitler saw the Me-262 as a vehicle to drop bombs at will over the hapless British and to terrorize them into foregoing the invasion. When he learned that the Messerschmitt factory was manufacturing these planes as fighters, he immediately ordered a redesign as a bomber. Due to the lack of a bombsight, the Me-262's performance as a bomber was dismal. The first missions, flown over the Normandy beaches, proved an exercise in futility.

Throughout the conflict concerning the plane's role, Adolph Galland flew several missions in the plane, chasing down RAF Mosquito reconnaissance planes and was so impressed that he ordered the assembly of the JG/7 jet fighter wing. During the final months of the war, 22 Luftwaffe pilots became jet aces in the powerful Me-262.

The Me-262, although proving satisfactory as a glide bomber, showed its true colors as a bomber interceptor. Rather than attempting a head-on pass, Me-262 pilots would ride high and behind the bomber stream, diving down through the fighter

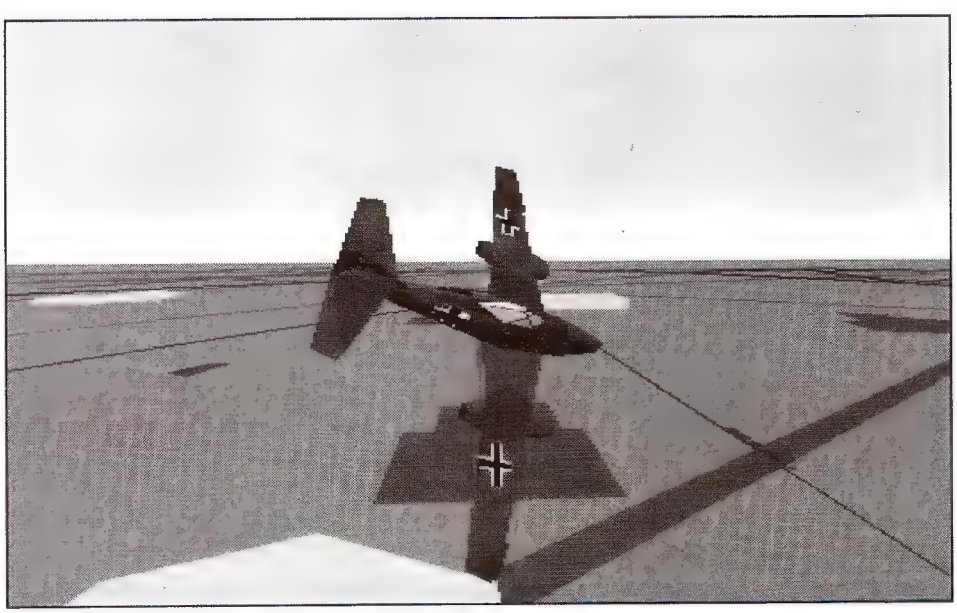


Figure 6-9

An Me-262 banking right in *Aces Over Europe*

escorts. Then slowing behind their targets, they let loose a salvo of rockets and finished the job with cannon fire as they dove away to safety.

During the last months of the war, the Me-262 final assembly-lines had to be hidden in underground mines and abandoned forest roads; the fuselages were camouflaged from prowling Allied planes. The awkward, ad hoc assembly of the Me-262 meant that the distribution of the planes was haphazard at best, and the shortage of fuel (the Me-262 utilized a kerosene blend) grounded many of the line fighters before they could ever become airborne. Nearly 1500 Me-262s were produced, yet only 300 or so ever saw combat duty.

In a traditional prop-driven aircraft, the thrust generated is related not only to the rate at which the propeller turns but also to the efficiency of the propeller—that is, how much "bite" the prop could put on the air. As a plane's speed increased, the efficiency of the propeller diminished and so did the available thrust.

On the other hand, a jet generates thrust directly, and the thrust remains consistent throughout the speed range of the aircraft, allowing much greater high-end speeds. By using the combustion of high-octane fuel to create a stream of high-velocity gas, the turbojet engine generates internal forces to spin a series of thinly bladed turbines that carry the hot gas to the rear for production of the rear-facing thrust. The turbine's rotation also drives a compressor that increases the pressure and velocity of the incoming air.

The Me-262 was equipped with twin Junkers Jumo turbojet engines that produced 1980 pounds of thrust each. Even though the power was sufficient to drive the Me-262 well over 500 mph, the plane was extremely slow to take off and was often picked off by Allied fighters as it attempted to taxi down the runway.

Table 6-21 Me-262 Offensive Capabilities

WEAPON	NUMBER	AMMUNITION	NOTE
30-mm Cannon	2	100/gun	
30-mm Cannon	2	80/gun	
250-kilogram Bombs	2		Strike Loadout
500-kilogram Bomb	1		Attack Loadout
R4m Rockets		24	Intercept Loadout

The complex mechanics of the engine did not enjoy sufficient testing time and were therefore very unreliable. The pilot needed to have a feather-light touch on the throttle, lest he burn out or set an engine aflame.

Had the Me-262 appeared several years earlier and been given sufficient time to evolve into a stable, anti-bomber fighter, the war might not have ended when it did.

In *Aces Over Europe*, the Me-262 lumbers on takeoff, the engines requiring several seconds to generate enough force to even budge the aircraft. Once airborne, the plane is still rather clunky until sufficient speed is built up. It begins to perform noticeably better at speeds in excess of 300 mph.

The 262 turns sluggishly, but control is sufficiently solid such that over-controlling a maneuver is not a problem. In aerobatics, such as a loop or an Immelmann, the 262 feels very heavy and drops nearly 300 mphs during the front half of a loop.

During a high speed dive, the 262 will begin to shake at approximately 600 mph and experience nearly immediate compressibility, followed almost instantly by serious airframe damage—mandating an immediate bailout, which will most certainly result in the death of the pilot.

In a dogfight the Me-262 is at a serious disadvantage because its maneuverability is poor and its high speed requires large-diameter turns. Against a bomber formation, however, the speed of the 262 and the superior offensive punch of the cannons are quite remarkable. Just remember that you must plan your attacks carefully to utilize the speed—the Me-262's prime advantage—and avoid remaining in the range of defensive gunfire for more than a few seconds.

When closing on a bomber target armed with rockets, remember that all 24 rockets fire as a single salvo. Aiming carefully will mean one heavy Allied bomber will go down in flames.

For landing, even though the speed is significantly higher than the other fighters in *Aces Over Europe*, control remains relatively solid, requiring an even hand.

Fighter-versus-Fighter Comparisons

The table below will give you a quick overview of Allied vs. Luftwaffe fighter strengths and weaknesses. By comparing how each fighter stacks up one-to-one you can develop a pretty good

Table 6-22 Fighter-to-Fighter Performance Comparison

	ME-109G	ME-109K	FW-190A	FW-190F	FW-190D	ME-262A
P-47D	A: s, f, [d] L: [m]	A: f, [d] L: s, [m]	A: [d] L: s, m, [f]	A: s, f L: m, [d]	A: [d] L: s, [m], f	A: m, [d] L: [s, f]
P-38J	A: s, f, [d] L: [m]	A: f, [d] L: s, [m]	A: s, [d] L: m, [f]	A: s, f L: m, [d]	A: f, [d] L: s, m	A: m, [d] L: [s, f]
P-51D	A: s, [m], f, d L:	A: [m], f, d L: s	A: s, m L: [f], d	A: s, [m], f L: [d]	A: s, [m], f L: d	A: [m], d L: [s, f]
Typhoon	A: s, [f], d L: [m]	A: [f], d L: s, [m]	A: s, [f] L: m, d	A: s, [f] L: m, [d]	A: [f] L: s, [m], d	A: m, d L: [s, f]
Tempest	A: s, [f], d L: [m]	A: [f], d L: s, [m]	A: s, [f] L: m, d	A: s, [f] L: m, [d]	A: s, [f] L: [m], d	A: m, d L: [s, f]
Spitfire IX	A: s, [m], f, d L:	A: [m], f, d L: s	A: s, [m] L: [f], d	A: s, [m], f L: [d]	A: f L: s, [m], d	A: [m], d L: [s, f]
Spitfire XIV	A: s, [m], f, d L:	A: [m], f, d L: s	A: s, [m] L: [f], d	A: s, [m], f L: [d]	A: s, [m], f L: d	A: [m], d L: [s, f]
Mosquito VI	A: s, [f], d L: [m]	A: [f], d L: s, [m]	A: s, [f] L: m, d	A: s, [f] L: m, [d]	A: [f] L: s, [m], d	A: m, [f], d L: [s]
Mosquito XVIII	A: s, [f], d L: [m]	A: [f], d L: s, [m]	A: s L: m, [f], d	A: s, [f] L: m, [d]	A: [f] L: s, [m], d	A: m, d L: [s, f]

KEY:
A: Allied planes; L: Luftwaffe planes
s: speed; m: maneuverability; f: firepower; d: durability
Brackets: a plane's primary strength

feel for when you have the advantage or when you will have to emphasize you own plane's unique ability to gain a victory over a numerically superior performer.

The ratings indicate the plane's performance against other fighters. Some planes (such as the Mosquito XVIII), even though they possess a 57-mm cannon, may not receive the advantage in air-to-air firepower.

The Bombers of Aces Over Europe

Throughout the air war, the role of bombers was the primary moving force. The Luftwaffe near the war's end concentrated on the production of fighters to intercept the Allied bombers, and many of the chief developments in Allied fighters came about because of a need for effective bomber escort.

Why then were these slow "whales of the air" so important? Because in the grand scale of the war, the tons upon tons of bombs that could be dropped from a single bomber mission could destroy (either permanently or temporarily) an industrial complex or major refinery or other target of significant military value.

The early air power visionaries who imagined bombers having carte blanche over an enemy's airspace were not wholly wrong in the value of strategic bombing. Though the fight proved more difficult than the bombers-will-always-get-through motto, the fact that pinpoint strikes could be made against significant targets behind enemy lines became a major factor in strategic planning. From a defensive point of view, these large scale bombing raids were equally as important, because it meant that all defenses had to be mustered to stop an incursion from the vulnerable ether above. Luftwaffe pilots fought with vigor to keep Allied bombers from destroying not only the BMW radial engine factory but also the surrounding hamlets that housed family and friends. It was a terrifying vulnerability.

Hardly any medium or heavy bomber, with the exception of the jet-powered Arado, could manage enough maneuverability or speed to evade incoming fighters—especially when loaded to the gills with ton upon ton of ordnance. For this reason, all but the Arado sported fearsome defensive teeth, the large formations becoming flying cites armed for any siege that might come upon them.

In *Aces Over Europe,* many of the missions you will fly will be either to intercept or escort these heavy war birds. Escort missions are markedly easier because you have the defensive fire of the bombers to aid you in your dispersal of enemy fighters. Escort missions also provide the advantage of a clear, predescribed flight path and destination. If you can stave off the fighters until the bombers can let loose their load, then your mission will at least be a strategic success.

Intercept missions require the cunning and courage of a warrior on a predatory attack, often outnumbered and outgunned. Intercept missions force you to take stock of your plane's abilities and to review your flight skills. It is not your job to dispose of the escorting fighters but to destroy the bombers before they can release their bombs. To do this, you must plan your attacks carefully, concentrate on evasive maneuvers, and keep away from the hail of defensive fire—always watching your tail for an enemy fighter.

The bombers are valuable prizes indeed to be protected or destroyed at all costs. Learn the abilities and weaknesses of the bombers in *Aces Over Europe* and exploit or protect them as best you can. It is a mission that was performed day in and day out for many long months over the battlefields of Europe.

Boeing B-17G Flying Fortress

Perhaps the most famous of all the heavy bombers was the B-17 Flying Fortress. Although not able to carry the heavy bomb load of the B-24, the B-17 was ruggedly built, allowing it to absorb massive amounts of damage and still be able to limp through the air.

In the early 1920s, the United States became interested in developing a big bomber capable of delivering a payload of 10,000 pounds of bombs. This lead to the development of the Barling bomber, a six-engined triple with an empty weight of 42,000 pounds. Although the plane was the largest in the U.S. at the time, it failed to exceed a flight speed much over 100 mph. As "the big one" it was a failure, but it did provide data that would be important in the development of the next generation of ships.

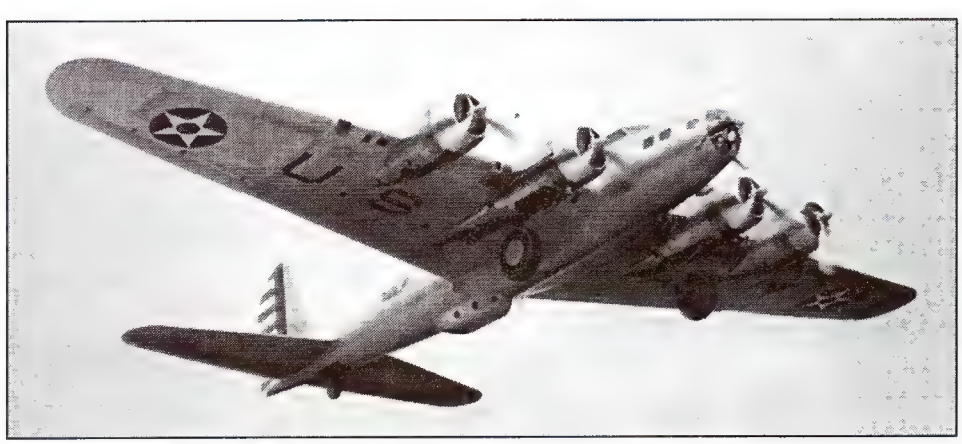


Photo 6-10

A B-17 flies overhead. Note the experimental gun emplacement on the underside of the plane.

The B-17's concept was initially put forward by Boeing in a design competition in 1933 and was first flown in 1935. In its demonstration flight, the plane greatly impressed the Air Corps until it crashed and burst into flames upon landing—obviously cooling the interest in the plane. By 1938, however, it was apparent that the B-17 was the best bomber in the world, and it began to fill the Air Corps ranks as their primary heavy bomber.

The B-17G, the most common late-war version of the plane, flew at speeds of up to 287 mph, powered by four, turbo-supercharged, Wright R-1820-97, air-cooled, radial engines, each producing 1200 horsepower. The plane was an extremely stable bombing platform—especially in the thin air above 20,000 feet—and the solid flight characteristics allowed the tight bomber formations mandated by the 8th Air Force.

The G featured twin .50-caliber, remote-controlled machine guns located in the plane's chin. This gave the plane more of a fighting chance against Luftwaffe head-on attacks. The bomber could carry 4000 pounds of bombs.

Consolidated B-24 Liberator

Although not as maneuverable or as rugged as the B-17, the B-24 could carry a payload 1000 pounds heavier than that of the Flying Fortress. The design specifications for the B-24 were laid out in 1939, relying heavily on the data and knowledge gathered during the production of the B-17. It was hoped that the B-24 would prove to be an all-around superior bomber. The big, 38,000-pound heavy bomber first rolled off the assembly line in San Diego in 1940.

The most distinctive feature of the B-24 was its double tail. The original single-fin design could not provide the needed flight stability given the plane's lengthy 110-foot wingspan, so the double-tail unit was added. Compared to the B-17, the B-24

Table 6-23 B-17G Defensive Statistics

TOP SPEED	287 mph	DURABILITY	Good
FIREPOWER	10, .50-caliber machine guns; all moveable	AREAS OF WEAKNESS	Steep-angle, diving, head-on attacks, diving attacks targeting rear base of wing

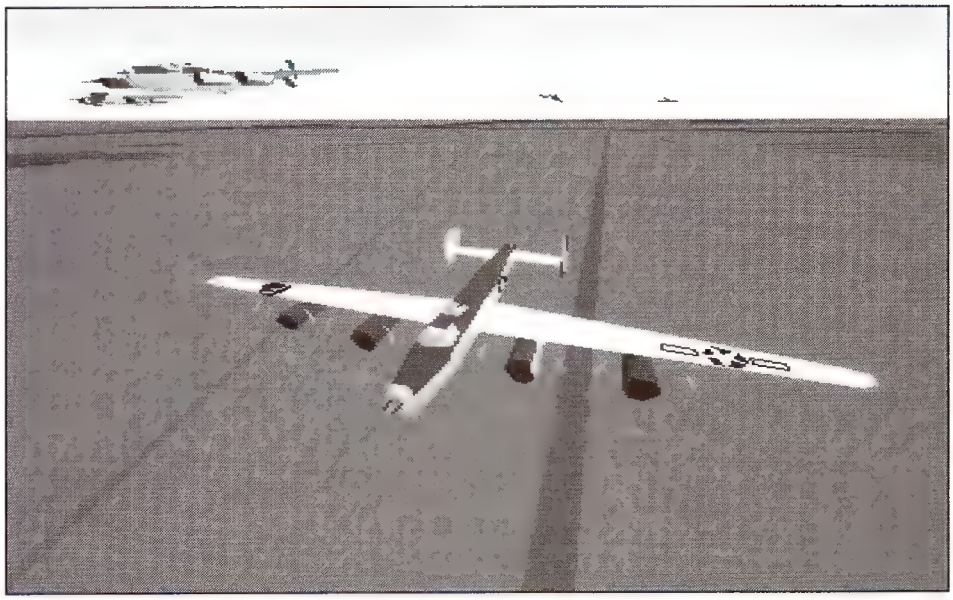


Figure 6-10

The B-24 Liberator in *Aces Over Europe*

possessed superior range and was often called upon for deep-penetration missions. Even with the J series' addition of front-mounted machine guns, it was still more vulnerable to Luftwaffe fighters than the B-17.

By the end of the war, over 19,000 of these heavy bombers had been manufactured. Powered by four Pratt & Whitney R-1830-43, air-cooled radials rated at 1200 horsepower each, the B-24J could achieve a top speed of 278 mph.

North American B-25 Mitchell

Although built in the United States by North American, the B-25 Mitchell served mainly as an RAF and Russian air force medium bomber in the European theater. Initially designed in 1939, the Mitchell entered full production in the late summer of

Table 6-24 B-24J Defensive Statistics

TOP SPEED	278 mph	DURABILITY	Good, though not quite as durable as the B-17
FIREPOWER	10, .50-caliber machine guns; all moveable	AREAS OF WEAKNESS	Steep-angle, climbing, head-on attacks; climbing attacks targeting leading edge of wing near fuselage

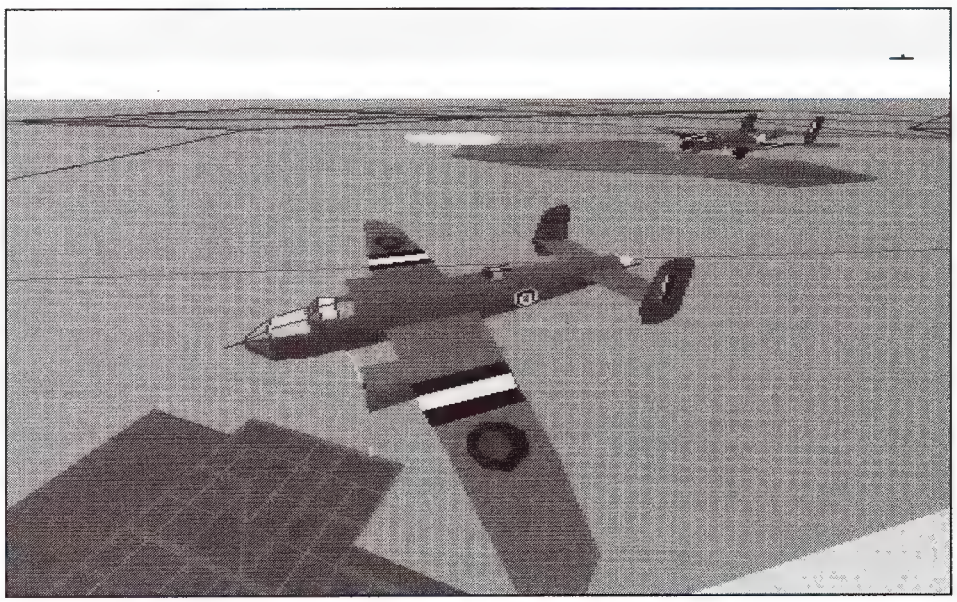


Figure 6-11

B-25 in flight in *Aces Over Europe*

1940, and nearly 10,000 of the planes were manufactured before war's end.

The B-25—powered by twin Wright Cyclone, air-cooled, radial engines delivering 1700 horsepower each—could achieve a top speed of 275 mph. The plane was stable and extremely predictable, making it a favorite of pilots who detested the touchy B-26. The double-tail assembly, similar to that found on the B-24, was a key factor in the plane's rocklike stability yet contributed to its sluggish maneuverability.

The stability of the B-25 allowed it to serve as a medium-altitude bomber; hence it was used against smaller, tactical targets. Its rugged and compact construction enabled the B-25 to stand up to enemy fire even better than the vaunted B-17.

Martin B-26 Marauder

The Martin B-26 served as the 9th Air Force's principal medium bomber throughout the war. The B-26 immediately earned

Table 6-25 B-25B Defensive Statistics

TOP SPEED	275 mph	DURABILITY	Excellent
FIREPOWER	6, .50-caliber machine guns; all moveable	AREAS OF WEAKNESS	Belly, between the wings, indefensible from the bomber's three gun turrets

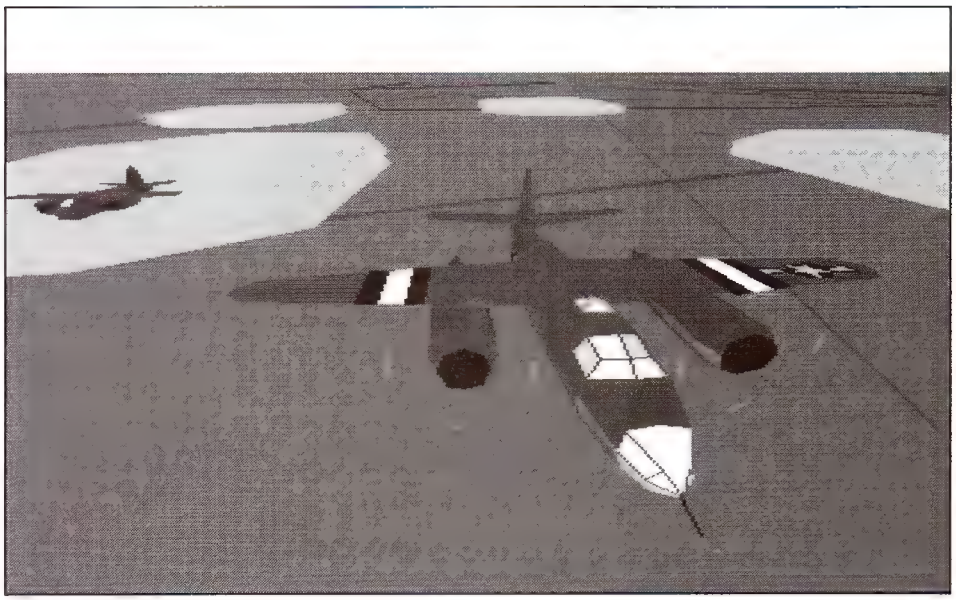


Figure 6-12

The B-26 "Widow Maker" in *Aces Over Europe*

itself a place of disdain in the hearts of the pilots who dubbed the B-26 the "Widow Maker" (because of its tricky flight characteristics) and the "Flying Prostitute," (because of its stubby, bloated appearance and short wings, revealing no visible means of support).

The B-26's awkward center of gravity and high landing speed made the plane extremely dangerous for rookie pilots to fly. A series of landing crashes called for a USAAF investigation in which the B-26 line was nearly canceled until design modifications revived its production. In all, 5000 of the medium bombers rolled off the Nebraska assemblyline.

The B-26 boasted 11 machine guns, covering nearly every possible attack angle. The plane was powered by twin Pratt & Whitney, air-cooled radial engines rated at 2000 horsepower each. With a top speed of 317 mph, it was the fastest Allied bomber.

Table 6-26 B-26 Defensive Statistics

TOP SPEED	317 mph	DURABILITY	Excellent
FIREPOWER	11, .50-caliber machine guns; 7 freely moveable	AREAS OF WEAKNESS	High-angle diving attacks to the front and cockpit area

Table 6-27 Ju 88S Defensive Statistics

TOP SPEED	379 mph	DURABILITY	Average
FIREPOWER	1, 13-mm rear-facing machine gun	AREAS OF WEAKNESS	Any frontal attack

Junkers Ju 88

The Junkers Ju 88 bomber served as a jack-of-all-trades for the Luftwaffe, flying missions as a light bomber, torpedo bomber, tank buster, and night fighter. The Ju 88 was first flown in 1936 and remained in production throughout the entire war.

Its chief advantage was its extensive service life—meaning that the plane's reliability and manufacturing procedures had been proven, allowing the Luftwaffe to concentrate on the development and production of its much-needed fighter corp. The plane was very maneuverable for a bomber and possessed excellent speed thanks to its light weight and a nitrous oxide injection system that allowed short defensive sprints of nearly 400 mph.

The plane was powered by twin BMW 801g-2 14-cylinder radials rated at 1730 horsepower each, providing an unboosted top speed of 379 mph. The engines themselves could take substantial damage, but the light, spindly airframe made it a plane of only average durability.

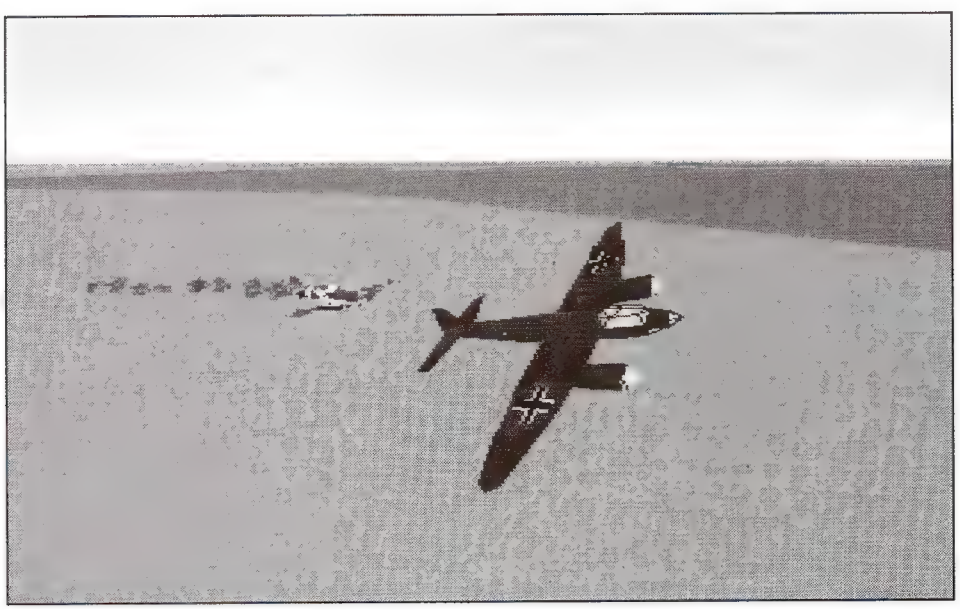


Figure 6-13

The Junkers Ju 88 under attack from an RAF Spitfire IX in *Aces Over Europe*

The two main weaknesses of the plane were its small payload capacity (only 1000 kilograms of bombs; not that much more than the Focke-Wulf 190) and its poor defensive armament (providing only limited, rear-facing protection). Because of this, the bomber relied on speed to outrun any attempts at interception.

Arado 234B

The Arado 234 was the world's first production jet bomber and utilized the same Junkers Jumo turbojet engines as found on the Me-262, giving the single-seat bomber a top speed of 460 mph.

The plane first flew in 1943, and the A series employed jettisonable landing gear—basically a wagon upon which the plane rolled until takeoff. The undercarriage was fitted with a single skid that facilitated grass-field landings.

The 234B or "Blitz" that served both in light-bomber and reconnaissance rolls featured retractable landing gear. Although the early versions of this plane were able to achieve significant flight speed, they could not manage easy takeoffs. To give the plane an extra boost, two reusable rocket engines were mounted under the wings to the outside of the turbojet engines. These rocket pods gave enough thrust for a reasonably distanced takeoff and were jettisoned once in flight, falling to earth safely by utilizing parachutes.

The cockpit of the 234B was plexiglass and gave the single pilot a frighteningly panoramic view of the air as well as the ground below. Since rear visibility was eliminated by placing the

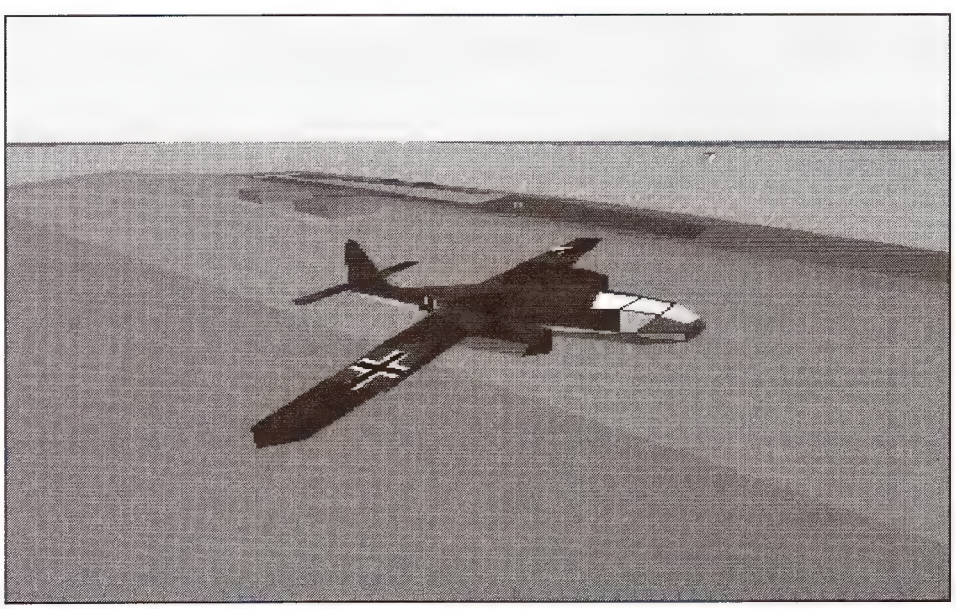


Figure 6-14

An Arado 234B struggles to become airborne in *Aces Over Europe*

Table 6-28 Arado 234B Defensive Statistics

TOP SPEED	460 mph	DURABILITY	Poor
FIREPOWER	None	AREAS OF WEAKNESS	Any area, especially the rear due to poor pilot visibility

cockpit in the nose, a modified tank periscope was installed to allow the pilot rear visibility. This periscope also doubled as a bombsight.

The Arado was deployed at the end of the war during the darkest time for the Luftwaffe. Often the planes were forced to make use of abandoned pastures as ad hoc airstrips. The pilots and crew would then chop down trees at the forest's edge to hide the planes during the daylight hours. When night came, the planes were wheeled out and sent on their way, returning before dawn. These temporary facilities were often only a few kilometers from the front, a desperate attempt to provide some measure of victory over the Allies as the Luftwaffe fell apart.

The Arado is the only dedicated bomber available for you to fly in *Aces Over Europe*, and it is also the most challenging plane in the game to fly.

Takeoff requires an even hand and steady, ginger handling of the controls. First throttle up to 90 percent, allowing the Arado to slowly gain ground speed. When the plane is rolling down the runway at a speed of 60 mph, apply half flaps (full flaps cause too much drag to allow the plane to lift off). At 110 mph, apply full, emergency throttle (F8 key) and when the plane reaches perhaps 160 mph (near the end of the runway), nudge the nose up ever so slightly. Keeping an eye on the altimeter, retract the landing gear as soon as you are gaining altitude, and maintain a shallow climb until you gain significant airspeed. Be sure to throttle back to avoid damaging the engines.

Table 6-29 Arado 234B Flight Characteristics

LENGTH	41 ft 5 in	TOP SPEED	460 mph
WINGSPAN	46 ft 3 in	LANDING SPEED	155 mph
WEIGHT EMPTY	11,464 pounds	CLIMB RATE	3350 ft/min

Table 6-30 Arado 234B Offensive Capabilities

WEAPON	NUMBER	NOTE
500-kilogram Bombs	3	Attack Loadout
1000-kilogram Bombs	1	Strike Loadout

With a full bomb load, the jet flies sluggishly and drops airspeed as the nose is pulled too high. Turns are slow, but the response is positive and doesn't require much overcompensation.

With the bombs dropped, the performance is noticeably snappier, and the plane will begin to develop some serious speed. In an emergency the plane can perform aerials such as an Immelmann, but will be near stall speed at the end of the maneuver (nearly 200 mph). Visibility is generally good with the notable exception of the seriously limited rear, periscope view. Landing the Arado is extremely difficult due to its high landing speed. Approach the runway with half flaps, throttling down to 20 to 30 percent, but keep your landing gear retracted until the last moment. Just over the runway with a speed just under 200 mph, apply full flaps and lower your landing gear. The object is to reach stall speed at a low enough altitude so that the plane will touch down rather than crash.

Photo 6-11

The plastic canopy of the Arado 234 gave the pilot almost too much visibility, letting him peer through his feet at the earth, thousands of feet below. The plane pictured, one of the only surviving 234s, is on display at the Smithsonian Air & Space Museum.

Preparing for Overlord

The combat deepens. On, ye brave,
Who rush to glory, or the grave!

Thomas Campbell

Perhaps the single most important event in the timeline of the Second World War was the Allied invasion of France—D-Day, June 6, 1944. Although the event stands out from the pages of the history books as a one-day mobilization of the Allied forces into Western Europe, the invasion (code named Overlord) certainly did not exist in a vacuum. The plans were a logistical tour de force.

A major precursor to the invasion was the successful, although costly, completion of the bombing raids of Big Week. In addition to the week-long series of bombing raids, continuing raids of German infrastructure sought to weaken Germany's ability to defend itself, both in the air and on the ground. In *Aces Over Europe*, you'll fly in some of these raids. Here we'll look at just a few.

The COSSAC Invasion Plan

In April 1943 Lieutenant General Sir Frederick E. Morgan, the Chief of Staff to the Supreme Allied Commander (COSSAC) was charged with preparing a well-researched plan for a transchannel invasion to be staged in the early months of 1944.

Primary in Morgan's drafting of the plan was the assumption that the Allied forces would enjoy air supremacy over the Normandy region of northern France. Operation Pointblank and

the targets of Big Week were aimed at crippling the Luftwaffe's offensive air capabilities and were a cornerstone of the COSSAC plan.

Prior to the invasion, aerial reconnaissance needed to be thorough. During the actual invasion, bombers were to conduct short yet heavy attacks on the Normandy beach defenses, coordinated to occur just before the landing craft reached France. During the unloading of troops from the crowded transports, Allied fighters were to blanket the sky above, preventing any Luftwaffe attacks from reaching the ground troops.

After the troops had reached shore, the bombers were to turn their attention to nearby enemy communication centers and Luftwaffe airfields in an effort to stymie any German attempts at land-based reinforcements. Next, air engineers needed to be positioned as quickly as possible to construct temporary landing strips. Then Allied fighters could act in a close support role with the advancing ground troops.

This plan—put forth in 1943—though still evolving provided a solid template with which the Allied air forces could concentrate on preparing for the forthcoming invasion.

Although the commanders of the 8th Air Force were reluctant to turn their attention away from the strategic bombing of Germany's wartime industries, their cooperation was essential to Overlord's success. The 8th Air Force would be needed, instead, in France.

An important aerial campaign that helped lay the groundwork for the invasion of Normandy was the destruction of the French rail system. Aerial and ground reconnaissance reported that a full three-quarters of French rail traffic was devoted to the maneuvers and resupplying of the German military. The Allies hoped that destroying the rail system would stymie the German retaliatory forces by interrupting their ability to bring troops and reinforcements into northern France.

One of the chief strategic doctrines of the day was the concept of isolating the battlefield. If a combatant could secure an advantage in offensive capabilities and then isolate the scene of conflict, victory was imminently probable. Following this doctrine, the Allies reasoned that concentration of ground and aerial forces would provide them with a numerical advantage in the region. By cutting off the arteries that fed the German forces into the area, they could establish a firm foothold. Moving in discrete

steps from that foothold, the Allied forces could then sweep over Western Europe.

There was considerable discussion as to the merits of attempting to disrupt the entire French rail system. The chief opposition came from the commander of the 8th Air Force, who felt that turning his bombers toward the German oil refineries would prove much more fruitful than destroying western rail targets. He argued that the Germans could still utilize a crippled rail system effectively and that the destruction of the rails would hinder the Allies' own liberation of France. He also argued that easing up on the strategic bombing of German targets would allow the Luftwaffe to build its fighter forces back up to strength and threaten his air superiority.

Eventually, Eisenhower decided in favor of the rail-destruction goal but also supported the continuing strategic bombing of Germany. This was to be coupled with more precise interdiction attacks against German convoys and communication centers, thereby doing the most damage while keeping the Germans off guard.

By March of 1944, the assault on the French railway system began—midmonth the results were already noticeable. By the time of the invasion, rail traffic had dropped off to a mere fraction of its January levels. The attacks against the rail system were initially focused on destroying rail centers, gradually grew in scope to include attacks upon bridges, and finally encompassed trains running on open rails. In one week in May alone, Allied fighters damaged over 500 locomotives.

The 9th Air Force was charged with the lion's share of rail strikes while the 8th continued its bombing campaign over Germany. Now its primary emphasis became the destruction of Germany's fuel-refining industries. By launching this two-pronged preparatory campaign, the Allies were able to rob the German forces of not only their rail mobility but also their ground-based transportation. At the same time, they were also causing a serious drain on available fuel for the Luftwaffe.

Interdiction Missions

Aces Over Europe allows you the opportunity to fly a variety of interdiction missions, performing pinpoint ground strikes on bridges, airfields, radar installations, and trains. Like the Close

Support missions, Interdiction missions are randomly generated, allowing you to fly the missions throughout the 14 months portrayed in the simulation. Some missions consist of preparation for the D-Day invasions while others might involve taking out an airfield or rail bridge in 1945. The great majority of the Interdiction missions are strikes against airfields and bridges. If you select Interdiction but do not like the mission you are given, select Cancel to return to the main menu and try again.

FLY SINGLE MISSION: INTERDICTION: U.S. ARMY AIR FORCE

The specifics of the mission are not detailed above because of the great variety of interdiction missions available to you. The following is a description of a sortie against a railway bridge in central France. This is one of the many missions you will fly in an attempt to disrupt the enemy's transportation and communication systems.

This particular mission is a strike against the St. Etienne railway bridge some 500 miles south of the airbase. Four P-47Ds are outfitted for a long-range strike, equipped with an external drop tank and ten underwing rockets.

When loaded for a long-range mission, the P-47 is sluggish during takeoff and requires a shallow ascent until enough airspeed is built up. Reaching an altitude of several hundred feet, select autopilot ([A]) to fly to your target.

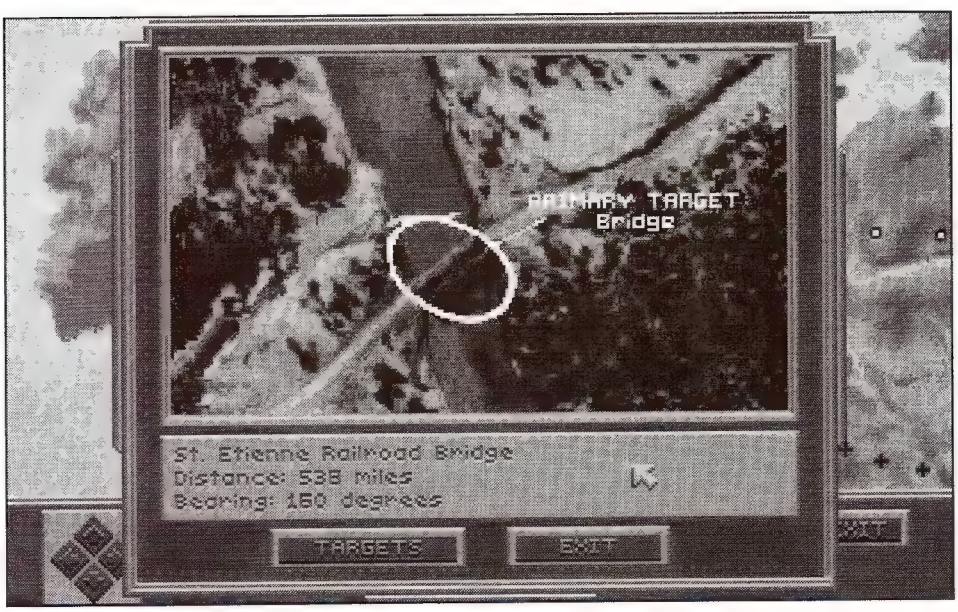


Figure 7-1

This recon photo, accessed from the Flight Map screen, provides a bird's-eye view of the area as well as precise target identification.

You begin in formation heading for the bridge at an altitude just under 3000 feet. Drop your external tank and begin a shallow dive, all the while scanning for enemy fighters. Throttling back to 60 percent lowers the airspeed to just over 200 mph, fast enough to initiate evasive maneuvers but slow enough to make a controlled attack run.

At just under 2000 feet and closing on the bridge, the flak towers begin to pepper the sky with shrapnel. When confronting flak on an attack run, the best strategy is to remain on course and keep your fingers crossed. The chance of a hit is low, but it is important for you to take out the primary target.

Firing rockets is tricky because they do not correspond directly to your aiming reticule. A good strategy is to line up a run that feels right, then let loose a salvo, tapping the R key to check your aim. A fortified bridge the size of the one at St. Etienne will take three salvos (six rocket hits) to be destroyed (or a single bomb hit if so loaded).

You will generally encounter at least two fighters at some point during your run. If you have steady nerves, take out the bridge first—throttle up to full immediately to break hard left or right.

Remember, the goal of the mission is the destruction of the bridge, not of the enemy fighters. Flight is your best option.If they intercept your planes before you finish your run, however, then you might be forced to fight. If you still have some rockets

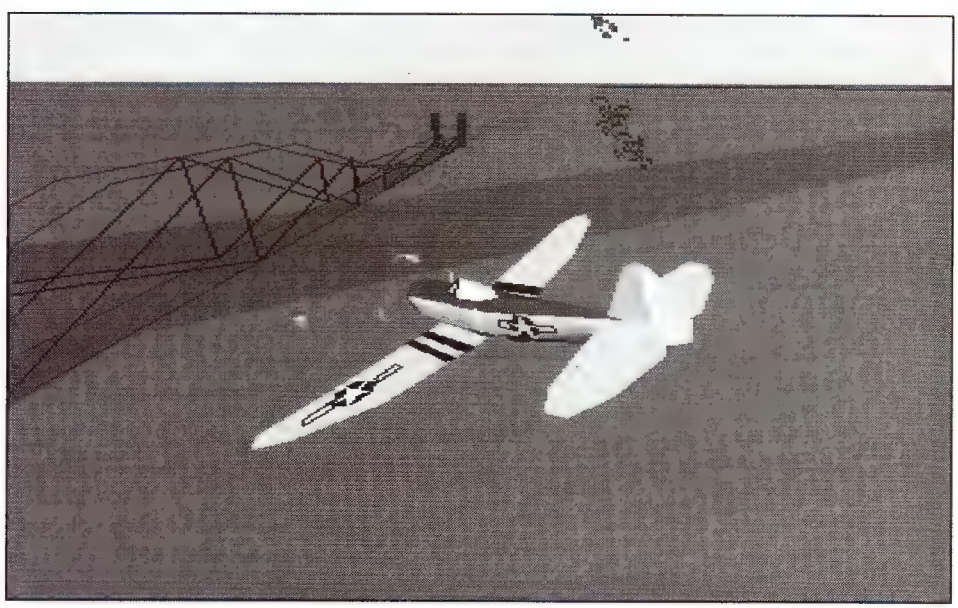


Figure 7-2

A P-47D lets a pair of rockets fly against the fortified railway bridge at St. Etienne, France. Notice the flak as well as the flak towers at the end of the bridge.

left, use them immediately at close range. The accuracy is poor, but you want to dump as much extra ordnance as possible to ensure peak performance.

After fleeing or dispatching the enemies, tap [A] to return to your airfield for landing.

Close Support Missions

Throughout the war, both Allied and Axis pilots were asked to perform surgical strikes against small tactical targets. A fighter aircraft was the perfect weapon for these strikes because taking out an enemy convoy would prove too costly for ground troops. First they would need to attempt to infiltrate the enemy lines, a difficult and dangerous proposition. Medium or heavy bombers, while accurate on a large facility, did not possess the accuracy or the defensive and retaliatory capabilities of a wing of single seat fighters.

The Close Support missions in *Aces Over Europe*, like the Interdiction missions, occur throughout the entire time period of the game and provide a random variety of missions, including attacks on truck or tank convoys, troop or munitions trains, or fortified positions. During WWII, these missions were generally carried out in support of a pending or ongoing ground attack or operation.

Missions which include the destruction of military trains on the French rail system in the spring of 1944 (part of the dismantling of the rail net) can be flown in the Close Support missions.

FLY SINGLE MISSION: CLOSE SUPPORT: U.S. ARMY AIR FORCE

Like the Interdiction mission, these are randomly generated so that the parameters of your mission might not match those of the following mission. Since destroying German trains in France was a prevalent goal in the preparation for D-Day, these missions are fairly easy to encounter under Close Support.

The following mission occurs on April 1, 1944, and the flight consists of four P-38J Lightnings outfitted for a long-range strike (two, 250-pound bombs). The goal is the destruction of a troop train moving east some 100 miles southeast of the city of Cologne.

Takeoff in a fully loaded P-38 is smooth, but the angle of attack must be initially shallow. After gaining enough altitude, select autopilot ([A]) to fly to the target area.

Autopilot will disengage if your flight travels near an enemy flight, and in this mission a trio of Bf-109s are patrolling above their airdrome some 150 miles due west of the target. Flying manually, it is time to check out the situation. If the Bf-109s are a good distance off, you can throttle up to full and hope to avoid detection. Since the sky is clear and the P-38s are loaded down, outrunning the 109s is an effort in futility. When faced with an unexpected encounter, to ensure clean performance from your plane, you must drop your external fuel tank (D) and release your bombs (Backspace). Your P-38 will now regain its fighting form, and you still might be able to outrun the German fighters.

If they circle in behind, you may have no choice but to attack. Use your radio by tapping the S key. By following the menus and selecting the function keys that correspond to the messages you wish to send, order your wing to attack.

When engaging the Bf-109s, take care to place your shots well and rely solely on your machine guns. If you can escape this encounter, the powerful cannon on the P-38 could be sufficient to destroy your primary target.

If you get clear of the encounter, autopilot to the train and set up for a gliding strafing run. Remember to keep your eyes open for enemy fighters, and save some ammunition for the long flight home.

From the Journal of Lloyd "Buster" Stinson

2nd Lieutenant, USAAF, 336th Fighter Squadron, 354th Fighter Group; April 17, 1944

...Jenkins fell under their damn bullets! He never saw the Hun. He was too busy trying to scrape one of the Messies off Roger's tail to check his six. I wish I could have been there for him...

Still, we had to travel for nearly 40 minutes before reaching the train. My breath just seemed to want to stay in my gut. I felt so heavy that it hurt. Every buckle and wrinkle in my parachute jabbed me, and I wanted nothing more than just to get back to base—get back to base and eat, for some strange reason.

I scanned the hazy, blue horizon for more trouble, but nothing came. Soon we picked up the rail line. I looked at my watch. If she was on time, then it was maybe 5, 6 minutes until we would get catch a glimpse of the steam bellowing from the locomotive. I checked my cannon, and it let loose a burst that was so loud I nearly cracked my head on the canopy.

Roger and Wilson fell to each side, making me the defacto leader for some odd reason. Roger had half a dozen more missions than me, but I guess I found the rails first.

There she was just ahead, passenger cars and two black-as-coal engines, rumbling through some small town that must have been a nice place to visit before it was overrun by the Jerries. I wondered if anyone still lived there, if families still baked bread in the morning and drank warm, fresh milk.

Up ahead, two dots—and I could tell right away by the nose they were Fockes. Damn. I checked my guts back there with Jenkins, and I wanted no part of this. I throttled down and began my glide, trying not to look at the fighters, who had certainly spotted us by now. I pretended that they just weren't there, that this was one of those odd dreams, just me and this train full of hundreds of Germans who wanted to take the whole world away from us. I began firing. The slow thump-thump of the shells coughed up basalt as I swooped over the train. I hoped that the sound terrified those troops, made them fear me for everything they made me fear.

Over the tops of the cars, and I just kept firing. Wood splinters sprayed the air. I pulled the nose back a bit as the shells began to edge into the locomotive's boiler. I wanted to see steam. I wanted that train to grind to a halt right then and there. I was nearly on top of it when I heard the whoosh of the boiler, and thick white steam enveloped me for an instant. Then the condensation just ran off my canopy as I banked hard right, nearly into a snub-nosed 190. I lay in fire for just a second or two, and all of a sudden, he was a ball of flame. No time to bail out at 80 feet.

I pulled up, banked to the west and gave it full throttle. I knew I was breaking away and I didn't look behind me for what seemed like and eternity. When I finally did, Rogers was my only company. We kept quiet for the long flight home...

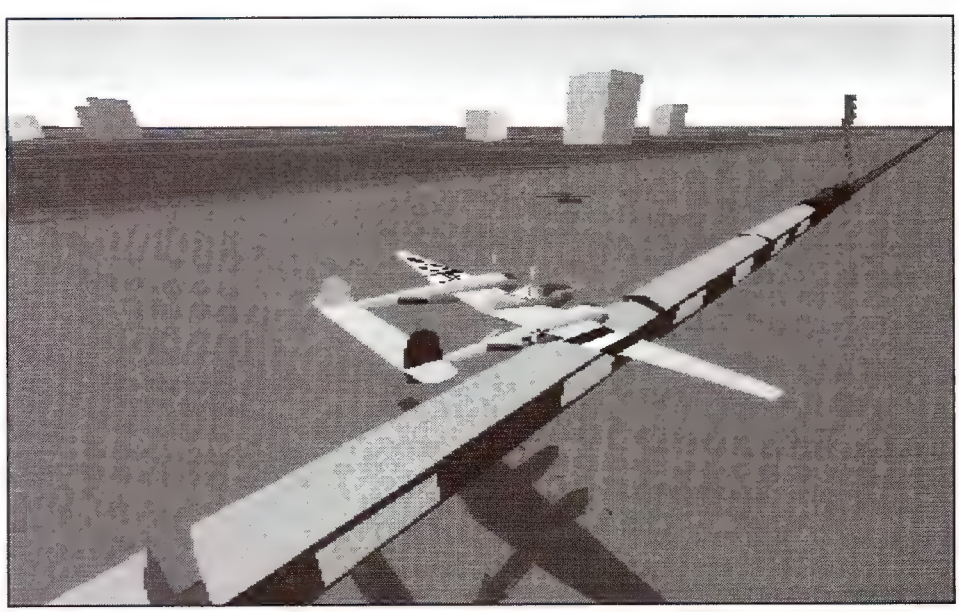


Figure 7-3

A P-38J strafes a troop transport train at low altitude.

Germany Struggles on the Eastern Front

In what started as an offensive ripe with the potential fruits of victory, the German campaign against Russia in the east began to collapse in 1944. The 900-day siege of Leningrad was broken by the end of January, and by early spring the Russian army had developed powerful momentum, reentering Estonia and recapturing Odessa.

The German forces were in disarray, exhausted and demoralized as the Russian troops were poised to recapture the vast Balkan oil reserves. Hitler was also well aware of the impending plan for an Allied invasion of France. He knew that if it proved to be successful, his Reich would fall.

Realizing the situation in the east was a loosing effort, Hitler knew that territory could be sacrificed in the east to provide forces to protect against the coming western invasion. In Directive 51, Hitler wrote: "Everything indicates that the enemy will launch an offensive against the western front of Europe, at the latest in the spring, perhaps even earlier. I can, therefore, no longer take responsibility for the further weakening of the west in favor of other theaters of the war."

The V-1 Rocket and Crossbow Missions

The Third Reich developed two "vengeance" weapons, both designed to be indefensible weapons of terror: the V-1 and the V-2. The V-2, designed by the German army, was a marvel of engineering. It was a potent, 30-foot rocket that could be launched from nearly anywhere, arcing through the sky to crash down upon the cities of England. While the V-2 heralded many design firsts, the giant weapon relied upon scarce raw materials and complicated manufacturing processes and bound up the German electrical component industries when time would have been better spent elsewhere. Although the V-2 could be considered invulnerable, the damage it caused did not outweigh the cost of production.

The V-1, a small, pilotless flying bomb designed by the Luftwaffe, proved to be a much more effective weapon. Although it did not possess the offensive punch of the V-2, the V-1 was much simpler to build. The V-1 could be air launched or could be ground launched from a long rail and flew on a straight,

Photo 7-1

A blurry glimpse of a V-1 rocket streaking over London rooftops

predictable trajectory to its target. Therefore, it could be intercepted and its launch sites could be located and destroyed. In the odd, backwards calculus of war, this proved to be a boon for the Germans. Since the V-1 sites were vulnerable, they became the chief targets of the Crossbow campaign and focused Allied airpower on the V-1s. This, in turn, provided some small measure of breathing room for the Luftwaffe, who were still reeling from the massive bombing raids of early 1944.

By the end of the war, more than 30,000 V weapons had been fired against Allied targets, and some 16,000 of them were V-1 rockets. The V-1 was a remarkably simple flying bomb, powered by a "stovepipe" jet engine that developed approximately 750 horsepower. The V-1 could travel at speeds reaching 650 mph utilizing butane as the fuel source.

The rocket–plane was launched from an inclined wooden rail and flew a precise, straight-line course to its target. Prior to take-off, the range of the target area was entered into the rocket's range counter. At the nose spun a tiny propeller, driven by the force of the air, that ticked off the range until the specified flight distance had been reached. Then a small explosive charge tilted

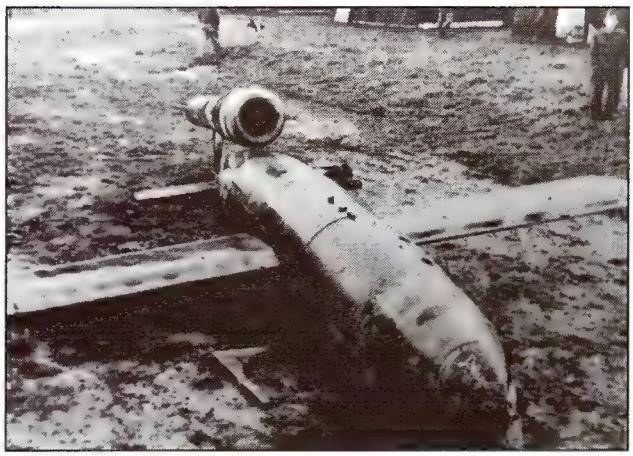


Photo 7-2

A German V-1 rocket—built under the guidance of the Luftwaffe—capable of speeds in excess of 600 mph

the rudder, causing the V-1 to dive earthward. A detonation pin in the nose fired the 1800-pound charge.

In May 1943, WAAF Flight Officer Constance Babington-Smith, an expert in the interpretation of reconnaissance photographs, examined a photo of Peenemunde in the Baltic and found a curious, never-before-seen installation. She identified a long, elevated ramp with a T-shaped object resting on top, an object that she determined was some sort of pilotless aircraft. The first V-1 site had been recognized.

Immediately, reports flooded in concerning unorthodox military installations, and by December of 1943 Operation Crossbow was implemented, utilizing Allied fighters and fighter–bombers to take out the V-1 launch sites. Churchill coined the Crossbow code name because he felt that these new German secret weapons were like the crossbows of old: inaccurate, clumsy weapons.

The Crossbow operations continued until the end of the war. During the first few months of operations, a full 40 percent of all reconnaissance missions attempted to seek out V-1 and V-2 sites. In all, over 1.25 million photographs were taken of potential Crossbow targets.

Some of the targets identified by aerial reconnaissance were curious "ski sites" featuring 300-foot-long buildings (often in pairs) pointing curiously toward London. Technicians who examined these photos felt that they might be the launching areas for giant rockets possibly exceeding 100 tons in weight, while others felt that they were nothing more than a giant ruse.

In the end, the Crossbow missions proved to be an expensive effort for the Allies. By D-Day, the Allied Air Forces had performed over 25,000 bombing sorties, losing over 700 men and

nearly 160 aircraft. The V weapons, although launched in great numbers, failed to do serious enough damage to alter the strategic course of the war, and it was estimated that nearly 90 percent of the large "ski sites" were destroyed.

FLY SINGLE MISSION: CROSSBOW: ROYAL AIR FORCE

The Crossbow missions challenge you to strike against V-1 multibuilding radar sites and V-1 rocket launch sites. The following mission is a strike against the Watten V-1 launch site, located 156 miles southeast of the Ford airbase. A flight of four Spitfire IXs, outfitted for a strike mission, will carry one 500-pound bomb each. The primary target is the V-1 launch ramp (which requires a bomb blast to destroy). The secondary target is the command bunker (which can be destroyed by 20-mm cannon fire). The V-1 site is guarded by three flak bunkers.

The mission begins just before dawn in the star-filled twilight of May 1, 1944. The weather is clear. After takeoff, autopilot will take you to the target site. On this day, however, four Focke-Wulf 190As are patrolling the channel several miles offshore, and autopilot disengages as you close in on their flight.

Immediately drop your bombs with the knowledge that the twists of fate in this war will doom your mission to a hard-fought partial success. In the ensuing dogfight, utilize your machine guns as much as possible to save your cannon for doing whatever damage you can to the V-1 site.

Remember to take into account your plane's advantage over the enemy: maneuverability. Remember also that the Focke-Wulf possesses a decided firepower advantage, especially if you are limiting yourself to machine guns.

Your best bet is to get behind the 190 and fire (from long range if need be) and to attempt to anticipate any evasive maneuvers to keep your position. Trust your flight to take out at least a few of the other planes, but also count on at least one friendly plane lost.

After dispatching the 190s, autopilot to the V-1 site. From the air, the launch site appears as only a brown rectangle. Throttle down to 60 percent and begin a slow dive. Keep your airspeed around 200 mph. As you approach, the flak emplacements will open fire, peppering the sky with surprisingly heavy flak. As you approach, immediately dive low to under 500 feet to foul their aim. You might want to switch to External view to get a bearing

of the target locations. Choose the secondary target, the command bunker, as your first pass and use your cannons. Aim carefully and fly low, but be sure not to fly so low that you might have to jerk the stack. Keep steady and on target.

Making a second pass, attempt to take out as many of the flak batteries as you can. By now, enemy fighters should be approaching.

Had this mission been part of a Career (see Chapter 9), your most prudent strategy would have been to switch back to machine guns and attempt an escape. Since this is only a single mission that you can replay many times—either from the Mission Recorder or by selecting Replay Mission at the mission's conclusion—you might try a few more daring attacks.

Attempt to strafe the V-1 ramp with your cannon. You will find it an impossibly difficult target to destroy with your cannon fire. Engage the enemy in a low-altitude dogfight to get a feel for tight turns in which altitude loss must be kept to a minimum.

Remember, these missions can serve as complete games in and of themselves, or you can think of them as advanced training missions that prepare you to enter a long and distinguished career.

The Luftwaffe Readies for the Invasion

The Allied bombing attacks against the rail system and against the airfields of France crippled the German attempts to dig in for the inevitable invasion. Allied intelligence forces through a

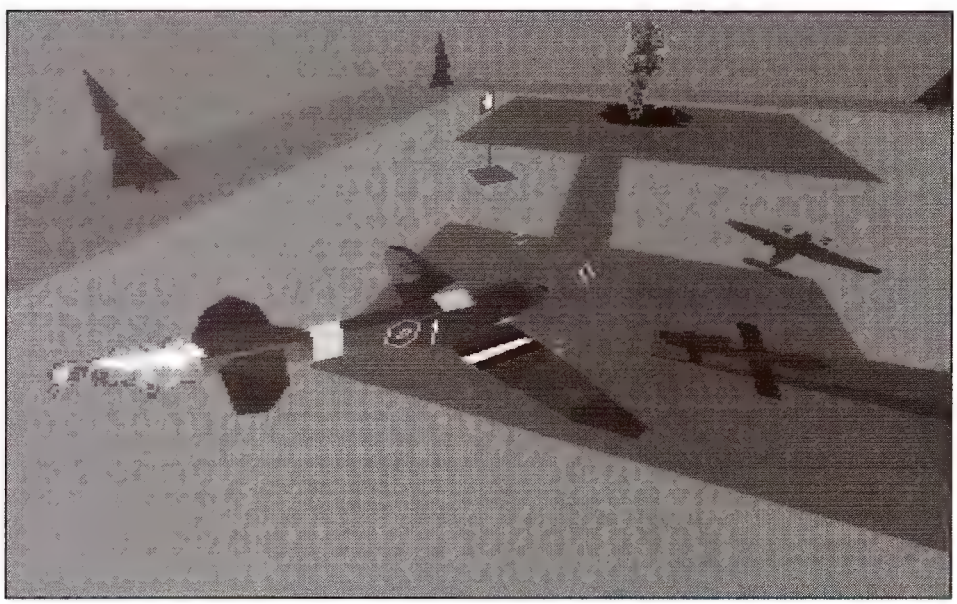


Figure 7-4

A wounded Spitfire IX dives in low to strafe the Watten V-1 site with its cannon. Note the V-1 rocket resting on the launching ramp.

program classified ultrasecret (or Ultra for short) had managed to emulate the German Enigma coding device and were able to break the German's encrypted positions (the British had also captured several of the German Enigma transmitters). The information the Allies now possessed told of damage to airfields, levels of fighter and bomber strengths, and incoming reinforcements. This knowledge was put to good use and allowed the Allied air forces an opportunity to empirically monitor the progress of their preinvasion campaigns and to systematically destroy Luftwaffe airfields near the English channel, which forced the bases to be relocated several hundred miles southeast of the invasion beaches.

The Luftwaffe anticipated the invasion and as early as December 1943 had developed a plan of massive aerial strikes against the landing forces. Revised in February of 1944, the plans echoed the strategic importance of thwarting a successful Allied invasion. They claimed that a "massed intervention of all the flying units in the first hours of a landing would be decisive for the continuation of the whole undertaking."

Unfortunately for Germany, the Allied attacks had destroyed all practical hope of Luftwaffe aerial superiority. In addition, the majority of the Luftwaffe's ground-support aircraft were gathered in preparation for a Russian offensive on the Eastern Front. This meant that fighters would have to bear the lion's share of retaliation. The pilots of these fighters were adept at air-to-air combat, but very few had received any training in close-support missions and were unskilled at flying a fighter heavy with the extra weight of the loaded bombs.

To make matters worse, the German weather forecasters misread the weather for June 6, 1944—D-Day—certain that it was too miserable for significant Allied activity and were caught totally by surprise. When the call did come to scramble, the orders were accompanied by a call to arms by Field Marshal Sperrle:

> *The enemy has launched the long-announced invasion. Long have we waited for this moment, long have we prepared ourselves, both inwardly and on the field of battle, by untiring, unending toil. Our task is now to defeat the enemy. I know that each one of you, true to his oath to the colors, will carry out his duties....Great things will be asked of you, and you will show the bravest fighting valor. Salute the Fuehrer.*

Historic Missions

Aces Over Europe allows you the opportunity to become a participant in some of the most exciting and harrowing aerial conflicts of the war. Rather than being missions that simulate the actual operation, these historical missions have been painstakingly researched to provide you with a recreation of an actual aerial battle. The historians at Dynamix, by working through the USAAF historical records at Maxwell Field, were able to determine the time of day, weather conditions, and airborne forces that clashed in 23 separate historical missions.

Selecting Fly a Historic Mission from the main menu will bring you to the Mission Selection screen, where you have the opportunity to select any one of the three services, the campaigns, and finally the individual missions. When a mission is selected, a short description will provide you with a general overview. Selecting Start will bring up a detailed mission briefing, provide a historic overview of the campaign in progress, and give you information on the specific mission selected.

You may choose from eight USAAF missions in five campaigns, nine RAF missions in three campaigns, or eleven Luftwaffe missions in three campaigns (with special emphasis on the Luftwaffe's desperate last missions in 1945).

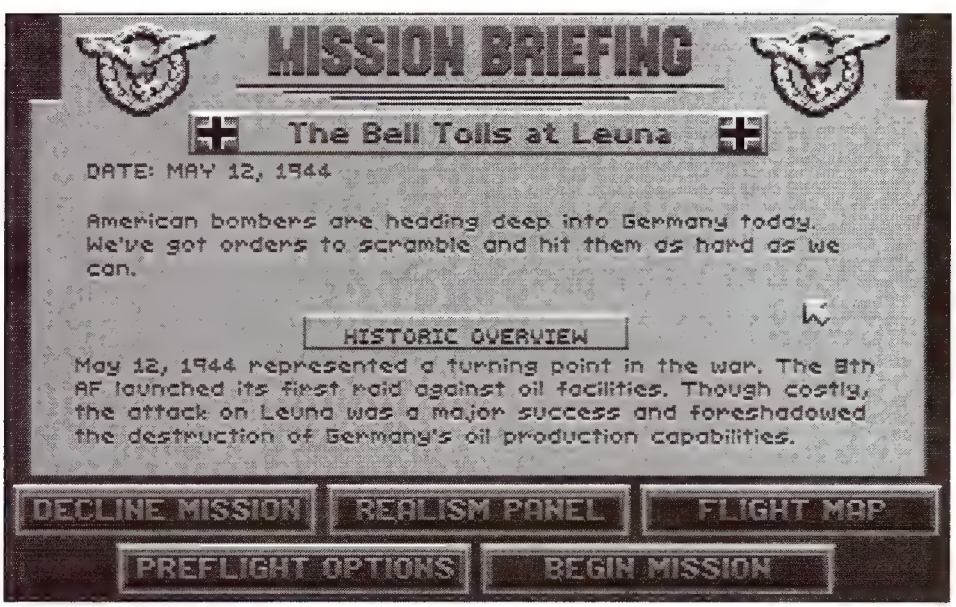

MISSION BRIEFING
The Bell Tolls at Leuna
DATE: MAY 12, 1944
American bombers are heading deep into Germany today. We've got orders to scramble and hit them as hard as we can.
HISTORIC OVERVIEW
May 12, 1944 represented a turning point in the war. The 8th AF launched its first raid against oil facilities. Though costly, the attack on Leuna was a major success and foreshadowed the destruction of Germany's oil production capabilities.
DECLINE MISSION
REALISM PANEL
FLIGHT MAP
PREFLIGHT OPTIONS
BEGIN MISSION

Fig 7-5

The Historic Mission Briefing screen

FLY SINGLE MISSION: FLY A HISTORIC MISSION: LUFTWAFFE: DEFENSE OF FRANCE

The only historic mission in this campaign is The Bell Tolls at Leuna, which takes place on May 12, 1944. During the preparations for the Normandy invasion, the 8th Air Force was asked to participate in the sorties over France, northern France in particular. Eisenhower did give the 8th permission, however, to initiate its bombing campaign on the German oil industry when it was not needed in France.

On April 15, 864 heavy bombers and 1040 fighters stood ready to undertake the experimental first strike on the German oil industry, a campaign that the Germans anticipated with great trepidation. Unfortunately, the weather did not clear until early May, and on May 12 the Allied forces took to the air.

The Germans had grouped many of their synthetic oil plants together, thinking in the early war that the Reich was untouchable territory. Now they stood vulnerable. On the morning of May 12th, 15 combat wings—some 900 bombers—headed for Germany. They were escorted by fighters from the 8th and 9th Air Forces. Nearing the city of Frankfurt, the Luftwaffe sent out nearly 200 fighters in massive attack groups, formed into Geschwaden (attack groups) of up to 30 fighters each as they swarmed the bomber stream. One Allied bomber wing suffered the loss of half of its planes and became scattered and disorganized, only to be rounded back together under the protection of Allied P-47s and P-51s.

The Allied bombers attacked oil facilities at Zwickau, Leuna, Brux, Lutzkedorf, Bohen, and other cities and dropped over 1700 tons of bombs. The Allied losses were heavy, with nearly 50 heavy bombers falling over the Reich. On the other hand, the defensive fire from the tightly grouped formations cost the Luftwaffe nearly 100 planes in a single day.

The mission is to block the progress of a wing of 12 B-17 bombers on their way to Leuna, utilizing your wing of four FW-190As armed for a long-range intercept mission with an external droptank and a pair of Gr.21 rockets.

As you approach the bombers, you will notice a straggler—a B-17 wounded from a previous encounter. Strike the crippled bomber first (remember to drop your external fuel tank) with a diving attack, then set your sights on the bomber formation for a

rocket attack. The Gr.21 rockets are extremely difficult to aim, and you will need to fly quite a number of missions with these rockets to get a feel for their quirky lob and explode deployment. When still a good distance from the flight, but close enough that some shading appears on the nearer planes, fire the rockets at perhaps a 20 degree angle above the formation. You can watch the rockets fly in their parabola and hopefully explode within the formation. Using the Mission Recorder to study the trajectory of the rockets is a good way to learn how to aim the Gr.21s.

You will not have trouble with enemy fighters during this mission, but the sheer number of bombers will provide a more-than-formidable challenge. Using your cannon as your primary weapon, you will find weaving attacks to be your most prudent strategy. Fly alongside the bombers, gaining several hundred to 1000 feet of additional altitude, then swoop down, peppering a single target with deflection fire. Cut through the formation and get out of harm's way as quickly as possible. Once on the other side of the bombers, repeat the procedure. You should be able to take out a single bomber each pass if you are careful and your aim is true.

This mission truly gives you a feel for the desperation of the Luftwaffe prior to the invasion. The airspace above the Reich belonged to the Allied bombers, and even though you are flying a high-quality fighter in the FW-190A you—like so many Luftwaffe pilots—are forced to battle overwhelming odds.

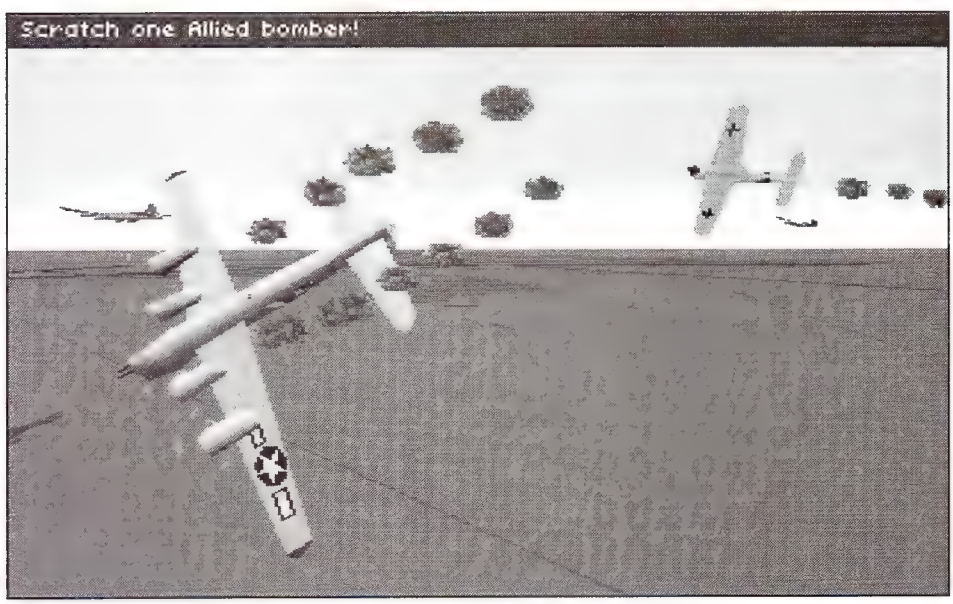


Figure 7-6

A B-17G goes down trailing smoke as an FW-190 breaks away to avoid the other bombers' intense defensive fire.

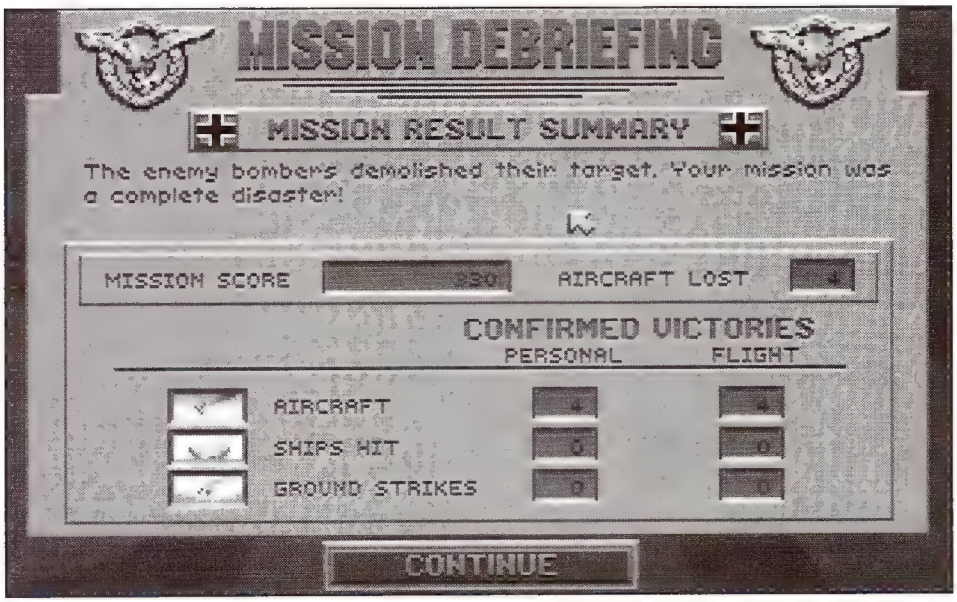


Figure 7-7

Even single-handedly taking out four B-17s does not necessarily mean a successful mission. What your commanders have asked you to do is next to impossible.

FLY SINGLE MISSION: FLY A HISTORIC MISSION: U.S. ARMY AIR FORCE: BOCAGE NIGHTMARE

On June 1, five days before the Allied invasion of Hitler's "Fortress Europe," nearly one million German troops stationed in Western Europe were dispersed along the Atlantic Wall, a 2400-mile-long coastal barrier linking nearly 30 heavily armed fortresses and defensive fortifications. Hitler knew that the invasion was immanent.

The amphibious assault across the channel was scheduled for June 5, 1944, but forecasts calling for poor weather delayed the invasion for 24 hours. The weather on June 6 was still gray and overcast, and the vast majority of the German commanders thought it was far too inclement for an invasion. Rommel was miles from the front, sleeping late after celebrating his wife's birthday, and Hitler was resting soundly.

The Allies had also produced a brilliant deception with Operation Fortitude, which included sending large hot-air balloons aloft that were fitted with radar deflectors. Meanwhile, RAF bombers dropped tons of aluminum Window (strips of foil which would fool the German radar), producing the effect of a large force mustering miles to the northeast of the actual invasion site.

Under cover of darkness, RAF planes had assembled the night before, and more than 900 planes and 100 gliders set out to attack beach defenses and inland targets and deposit the first wave of

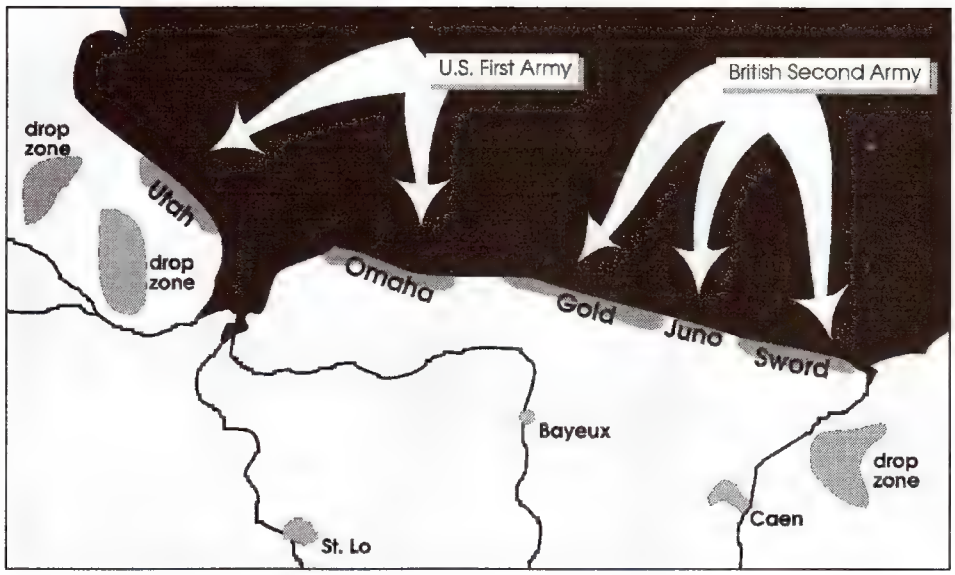


Figure 7-8

The invasion of France. Forces were split to attempt to capture and hold five beachheads as well as several inland positions. Initial airborne drops delivered crack troops inland, and continuous aerial sorties scoured the air for miles beyond the landing sites.

troops. The diversion caused by the dropping of Window averted any attempts at interception, but as the planes flew inland the German radar network picked up the planes. The darkness sparkled with the explosions of dense flak. The RAF forces became disjointed, dropping their bombs either too early or too late. Even through the confusion and the loss of just over 50 planes, the Allied forces managed to perform over 1600 sorties during the night of D minus 1.

At 6:31 A.M., right on schedule, the first Allied troop carriers lowered their ramps on Utah Beach, and the din of the massive aerial support and preparatory shelling forced the Germans stationed at the beachhead to cover their ears. For them, the invasion had suddenly become very real.

During the morning of the invasion, as the armada of Allied seaborne troop convoys crossed the channel, the 8th and 9th Air Forces provided extensive air cover as well as support for the landing. As the ships bounced over the choppy waves, Luftwaffe resistance was nonexistant. Three Focke-Wulf 190s were chased off by escorting P-38s, but no damage was done to the convoy.

The 8th Air Force was also charged with leading a massive bombing strike of the fortified locations and the inland defensive positions. The skies were overcast, so the missions had to be

performed on instruments—careful timing of the bomb releases was crucial. It was stressed in the premission briefing that overshooting targets was far preferable to undershooting and risking losses of Allied troops. Bombardiers were instructed to delay the release of their load by up to 30 seconds after the bombsights had located the target. Nearly 3000 tons of instant fuse bombs were dropped, set to explode on impact to minimize heavy cratering and thus impede the Allied ground movement in the coming days. Thirteen hundred B-17s and B-24s flew on the initial mission six squadrons abreast as they approached at right angles to the invasion's beachhead and completed the mission with the loss of only a single plane.

History dilutes the effect that the preparatory strikes had on the success of the invasion. The sheer scale of the Normandy landings tends to overshadow the missions performed in the previous months, missions that hobbled the German ground resistance and effectively took the Luftwaffe out of the game. Had the Luftwaffe maintained a strong presence in northern France, then the landing of the hundreds of thousands of Allied troops would have provided a turkey shoot for the German pilots.

As it stood, Hitler did not order the deployment of German reserves until after lunch, after the Atlantic Wall had already been breached in several locations. For the ground troops, the invasion did not go as smoothly as it had for the pilots. The German defenses were still strong, and many fortified positions enabled the Germans to created a wall of fire that the Allied forces had to wade through. By nightfall, even though the Allied

Photo 7-3

View from inside one of the Allied landing craft showing troops splash ashore at Normandy Beach

forces held the beaches and were advancing, they had sustained well over 3000 casualties and were aware of the dangers of the days just ahead.

Of the three missions in the Bocage Nightmare campaign, two occur on D-Day, June 6, 1944. Select the Tree Clippers Inc. mission to take on the role of Colonel Hubert "Hub" Zemke, leader of the 56th Fighter Group stationed at Boxted Airbase in southern England.

Throughout the day of the invasion, more than 8000 Allied fighters and bombers flew over 14,000 sorties. One of the principal missions for fighter wings was ground support, sweeping the territory behind the beachhead and locating and destroying German vehicle traffic—often small convoys of light and heavy tanks along with trucks carrying troops and munitions. In this mission, Hub Zemke and his wingman were to rendezvous with another pair of P-47s and fly 260 miles south, scouring the region just south of the Rouen rail switchyards.

When Zemke's flight located a convoy of trucks and light tanks, a pair of P-51s were already making an initial strafing run. As the Thunderbolts descended, they were bounced from behind by a wing of four Focke-Wulf 190As coming in fast flown by experienced pilots. In the ensuing battle, Zemke took out two of the Nazis, but not until after they had taken down one of the P-51s from the 352nd Fighter Group.

Colonel Hub Zemke

Zemke will be remembered as one of the outstanding fighter commanders of WWII. His skills as a combat pilot earned him 17 hard-fought kills with the 56th Group. Not only did he possess outstanding piloting ability—he was also a true leader and excellent tactician.

In the early years of the war, Zemke's 56th was selected to be the first group to receive the new P-47 Thunderbolt while still stationed at Savannah, Georgia. The 56th was instrumental in testing the P-47 and working out many of the plane's glitches. By late 1942 when the 56th was moved to England, the P-47 had worked through several modifications and the 56th's pilots were skilled with the new plane.

The first months of the 56th's combat duties were marked with poor performance, capped off by a May 1943 incident in which

one of the P-47s made its first enemy kill. It turned out to be not a Luftwaffe plane at all but an RAF Spitfire (the pilot had parachuted to safety). Through the trials and tribulations, the 56th gained skill and experience and by the fall of 1943, it had become a formidable fighter force.

The "Zemke Fan" proved to be a valuable strategy by which to employ P-47s as bomber protectors. The P-47, because of its range limitations, was eclipsed as an escort plane by the technologically superior P-51. To improve the 56th's chances of meeting an enemy, Zemke experimented with the tactic of sending his planes out in advance of the bomber stream and having them then split up over 180 degrees to search for enemy fighters. If Luftwaffe planes were spotted, the pilot radioed for reinforcements—which were already airborne.

Zemke was a solid tactician who used his creativity and his common sense to create situations in which his P-47s could gain every possible advantage over the enemy. He advised:

> *If the enemy is above, never let your speed drop and don't climb, because you'll lose too much speed....I stay with the enemy until he is destroyed, I'm out of ammunition, he evades into the clouds, or I'm too low on gas or ammo to continue. When you have your squadron with you and the enemy has so much altitude you would never get up to him, stay below and to the rear—he'll be down. Learn to break at the proper time to make a head-on attack—the enemy doesn't like it. Don't run. That's just what he wants you to do. When caught by a large force, the best policy is to fight like hell until you can decide what to do....*

Into the Air

In this mission you are flying as Zemke, and both you and your wingman's P-47Ds are loaded out for a strike mission with a single 500-pound bomb and 10 underwing rockets. As you look over the Preflight Options screen, remember that in an Historical mission you cannot alter the mission settings.

You will begin your mission at Boxted Airbase. Take off and use autopilot to rendezvous with the other pair of P-47s. Autopilot again to Rouen switchyards (it is now nearing dusk and you can see the switchyards and the town of Rouen below), and then again to the convoy to the south. As you approach, you'll receive word that there are friendlies attacking the convoy of

trucks and two Whirlwind tanks (mobile flak units protecting the convoy from the front and rear). As you head down for your first attack run, be sure to check out the surrounding territory for any sign of enemy fighters.

In a shallow dive, you will have to release your bomb sooner than you might think because it will still carry much of your plane's forward velocity. You must use it first since it is the greatest detractor from your P-47's mobility. Attempt to take out the Whirlwind tanks to reduce the flak you will have to fly through.

Whether or not you choose to attack the convoy first, you will have noticed the flight of four Focke-Wulf 190As approaching from the rear. Use the radio (S key) to inform your flight of bandits approaching from the rear.

In this battle, the FWs have every advantage: speed, altitude, maneuverability, and firepower. As you keep your eyes on the approaching planes, you might want to see how much damage you can do to the convoy.

You will discover that unless your flight skills are at the Expert level and luck is on your side, the FWs will descend like banshees and destroy your plane before you can do much more than take out a single truck or tank. Remember that you are flying as Hub Zemke, and heed his above words.

Replay the mission, and this time think like Zemke. When you first notice the FWs, take stock of the situation. As you discovered in your first attempt, the P-47D when loaded with

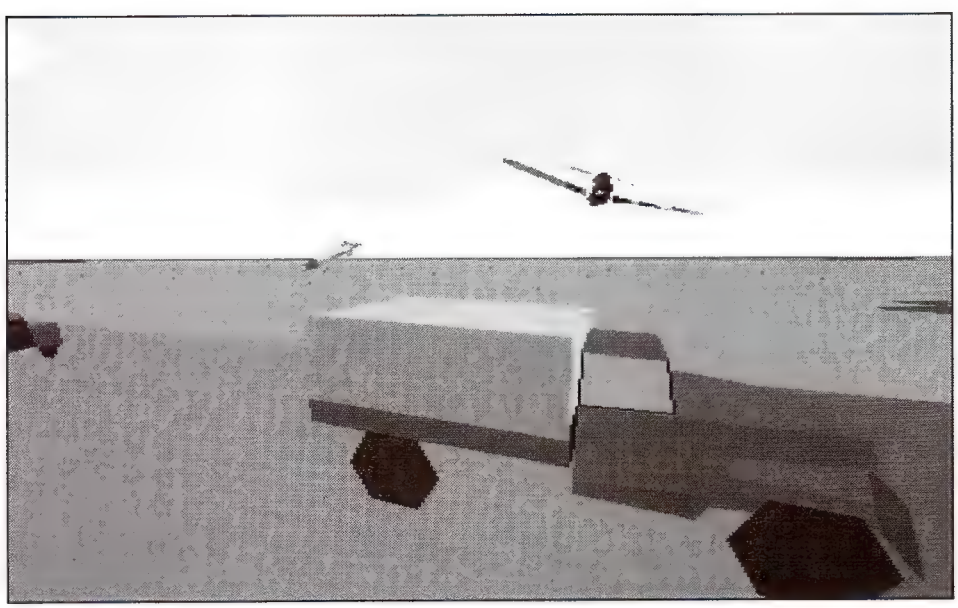


Figure 7-9

Flying low to take out a truck with a rocket salvo. Remember to pull up your P-47D as soon as you release the rockets.

strike ordnance fights like a snail and never builds up significant airspeed—turns almost in slow motion. To counter this, you must drop your ordnance, convoy or not. Your flight cannot read your mind, and they are too busy watching the fighters and the convoy to notice you dropping your bomb and releasing your rockets (aimed at the convoy, of course, hoping for a lucky hit or two). Use your radio; select F5 then F1 to order your flight to attack the fighters. You will receive confirmation that they are dropping their ordnance and turning to fight.

You next step is to turn the tables and take the offensive lead in the aerial battle—forget about the convoy. Begin to turn, keeping an eye on the incoming FWs, and attempt to get into a favorable situation. Do not turn too tightly, or you will bleed off too much speed. Also, remember to turn into the flight, not away from it. This will give the Luftwaffe pilots the least possible time with you in their sights.

As they come in and begin the engagement, you will notice that your plane is much more nimble and they have slowed due to the low altitude. The tables have been somewhat equalized. In battling these planes, utilize Full Guns when an enemy is close and sure. You can generally take out an FW-190 with just a burst or two from Full Guns. When fighting from medium to long range, your deflection bursts will necessarily be longer, so switch to only one set of guns to conserve ammunition.

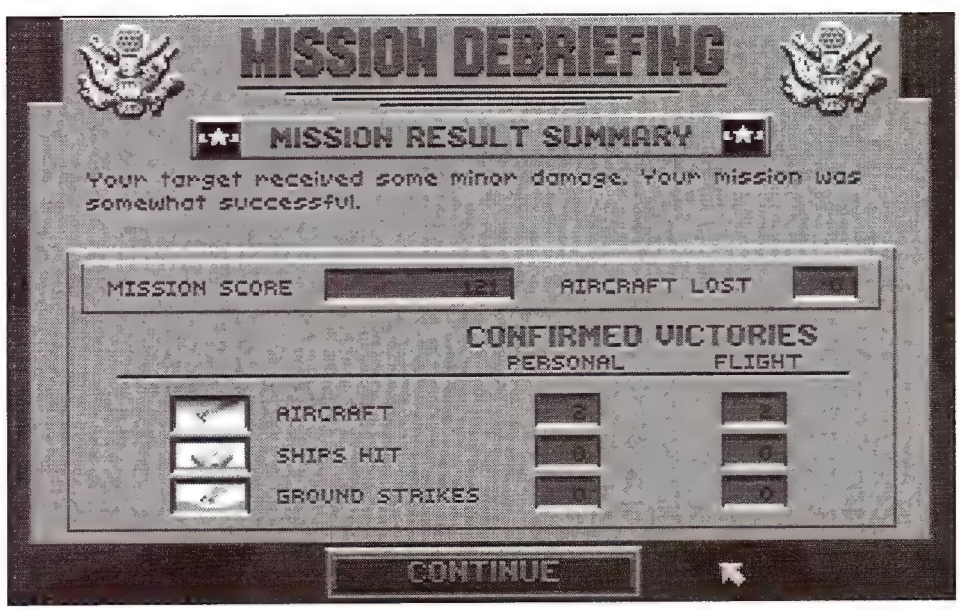


Figure 7-10

Like Zemke, you can take out two Focke-Wulfs on June 6, 1944.

With careful flying, aggressive combat tactics, and a modicum of common sense, like Zemke you can return from your final sortie of the day knowing that you and the 56th did your part to aid in the invasion effort.

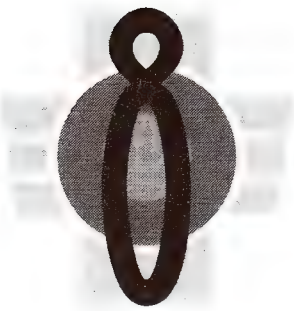
Beyond D-Day

By sunset on June 6, 1944, the Allied troops had clawed their way inland nearly a mile and a half at places. This spread the Allied forces thinner than they would have liked and caused them to still be very vulnerable to German artillery attacks.

On June 7, 467 sorties were launched, targeting five primary German artillery positions as well as troop and tank movements. For the great majority of the flights, specific targets were not designated. Instead, regions were to be scoured and it was up to the individual squadron leaders to select targets.

For the next week, fighters and bombers flew countless missions as the ground forces pushed ahead through the thick Normandy hedgerows. By June 12th the five beachheads had been linked, and Allied forces controlled the coastline to an inland depth of 15 to 20 miles. Although the fighting had been hard, the Allied forces both in the air and on the ground were relentless.

The constant fighter missions buzzed about northern France, leaving no roadway or rail line unnoticed. As one German soldier remarked, "The American fliers are chasing us like hares." While Germany now faced offenses from the east, west, and south, one question remained: what, if anything, could the Luftwaffe do?



Secrets of Battle: The Art of Combat Flying

Nine-tenths of tactics are certain, and taught in books; but the irrational tenth is like the kingfisher flashing across the pool, and that is the test...

T. E. Lawrence

Read through the history books and you will find accounts of air battles won and lost and of aces victorious or killed. These accounts usually reflect the strategy of a battle, the plan of the attack, the number of planes, and the significance of the targets. Rarely will you read about the minute-by-minute tactics of an aerial dogfight.

Yet, as a pilot in *Aces Over Europe* you not only fly your craft—you become a skilled warrior. As you work the myriad of missions available to you, you will learn about the historical context of each mission and its place in the grand scheme of the war. Foremost on your mind, however, will be the immediate goals of the mission: "How do I accomplish these?" Throughout the chapters of this book, you have flown many missions and immersed yourself in the world of fighter combat. You have learned maneuvers and essential strategies. Now you can go into a dogfight, guns blazing, twisting and turning with your opponent—it may work. If it doesn't, you can replay the mission and try again. Yet for the pilots who flew in WWII, this was not an option. There were no trials by fire that were less than deadly. A mistake could cost them everything.

True, pilots fought for the good of their nations, fought to preserve honor and to accomplish the goals of their mission. Never forget, though, that they fought because if they didn't, they would

not survive. They had to develop sound combat strategies in order to live—it's time for you to stop flying by the seat of your pants and learn the battle secrets!

The tactics of aerial combat given below are general observations and procedures, information aimed at making you a quicker, more knowledgeable fighter pilot. However, it is your ability to adapt, to take your skills and use them in the situations you encounter that will keep you alive. You must be flexible and you must be creative—a tactician and an athlete. Like the pilots of the WWII, you must think on your wings quickly and clearly or your career will be a very short one indeed.

Aerial Maneuvers

In Chapter 4, you worked through flight training much as the pilots of the Second World War had to, studying and performing and always eager to practice. In flight training, cadets learned not only the basic maneuvers covered in Chapter 4, but also more advanced combat maneuvers. They practiced them for hour upon hour in mock dogfights until the execution of the maneuver became second nature.

Beyond simply developing an accessible grammar of aerobatic maneuvers, you will need to know when to use them. Cadets learned these skills in their months of training, but only partially. It was not until they had entered the war as combatants and had fought many times that they would begin to evolve into true fighter pilots. The old axiom of trial by fire is the greatest teacher was most certainly true.

To practice the maneuvers, the Aerial Gunnery training mission is the best place to start. Here you will encounter dangerous opposition, have targets to interact with, and begin at a decent altitude. The only limitation in the training missions is that you have limited control over the type of planes you may fly. Setting up other single missions will allow you the opportunity to fly every plane in the game in order to get the feel for the unique capabilities of each.

Inverted Flight

Inverted flight is accomplished by performing an aileron roll and neutralizing the controls as you become inverted. When flying inverted, the elevators work with opposite results than in normal flight: pushing the control forward will result in a climb.

Figure 8-1

A Bf-109K in inverted flight

Turns are more difficult in inverted flight because of the plane's predisposition to lose altitude rapidly. Also, it is far easier to black out when attempting maneuvers in inverted flight, so keep your control movements gentle.

In and of itself, inverted flight is not very useful, but there will be times when inverted flight skills can provide you with an advantage. When maneuvering on an enemy—especially when making a pursuing tight diving bank—you may find your plane rolling over as you attempt to get a bead on your opponent. During a tight and deadly dogfight, in the time it would take to roll to level flight and aim your guns you might lose an opportunity for a shot. Becoming adept at inverted gunnery will allow you to create an offensive situation when one otherwise might not have existed. Use the Aerial Gunnery training mission to practice diving inverted attacks on the drone planes. You might find that using your rudder control (which still operates normally) is a good method for inverted aiming.

Inverted flight also can be used to perform a diving strike on a bomber formation. Flying inverted above the formation and utilizing the Up and Forward (F5) view, you can select your target before you initiate a diving attack.

Knife-Edge Flying

Flying on the knife-edge is flying with your wings perpendicular to the ground, allowing your plane's fuselage to act as the

airfoil. As you might imagine, a plane's fuselage is not designed for this. The plane is predisposed to begin a high-speed dive.

Rolling on the knife-edge requires neutralizing your ailerons when you reach the sideways position, then applying the elevator to turn the maneuver from a gentle bank turn into straight flight. Keep your eye on your V.S.I. and apply the rudder to keep your dive as shallow as possible. In knife-edge flight, the dive feels deceptively smoother than in level flight. If you are not careful, your airspeed will soon build up to dangerous levels. Flying knife-edge will give you very little offensive advantage, but being able to control your plane in this type of flight might become a matter of life and death—how else will you tear through a tight formation of bombers with very little room to spare?

Skid

The skid is a sliding maneuver in which your plane moves left or right without any great change in yaw. To skid, dip one wing slightly and apply opposite rudder. Your plane will continue forward flight but will drift gradually to the direction of the dipped wing.

Perhaps the best way to learn how a skid works is to switch to the External view. Rotate to a bird's-eye view of your plane and zoom out (the [and] keys control the zoom level for the External view) so that a landmark on the ground is visible. Practice performing a skid—stick in one direction, rudder in the other—and observe the results.

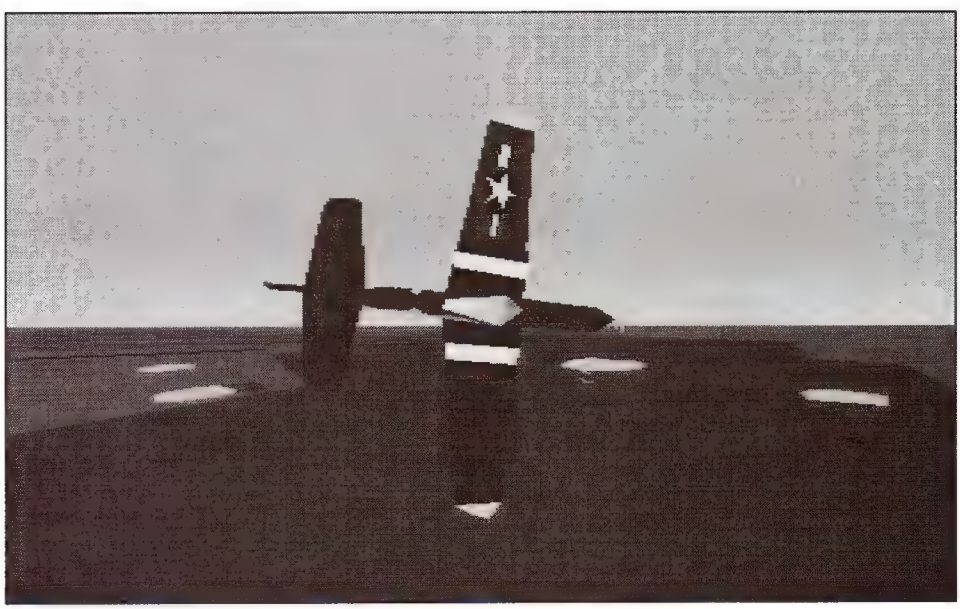


Figure 8-2

A P-51D flying on the knife-edge. Note that the nose is dipped, indicating a slight dive.

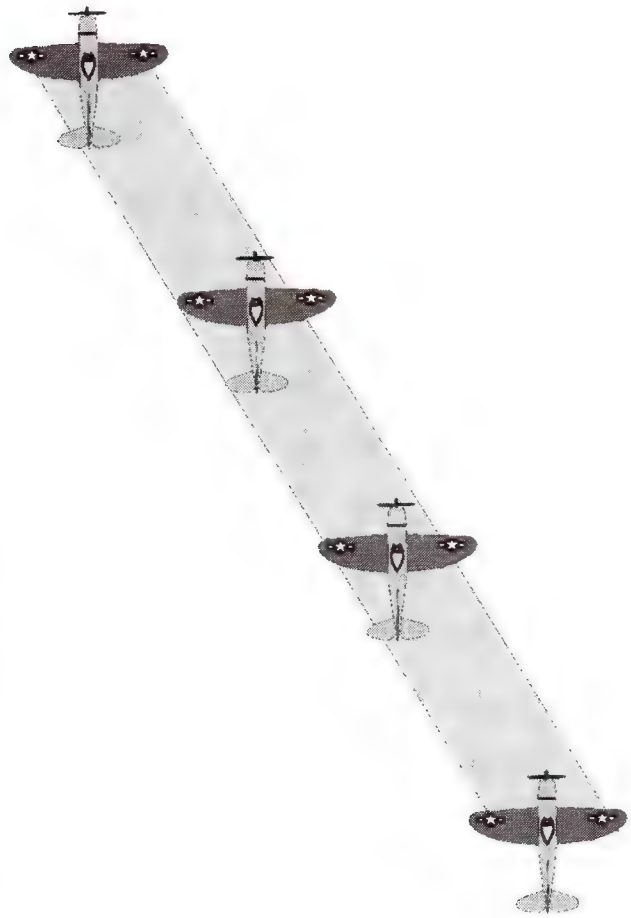


Figure 8-3

A skid to the left. The plane slides left, but there is no change in yaw. The plane will fly straight after the controls are neutralized.

An extreme skid (when you dip the wings significantly and apply full opposite rudder) can be an excellent defensive tactic when you have a plane bearing down on your tail and opening up fire. Generally, the attacking plane will interpret the skid as a turn and will bank away, throwing the guns off target.

If you nose down slightly in a skid, you can lose altitude gradually without building up additional speed, which can be very useful when rejoining a bomber flight that you are escorting.

Split-S

The Split-S is essentialy an Immelmann in reverse with one important difference: it produces extreme stress on your plane's airframe. The Split-S was rarely performed during the First World War because the more fragile planes could not handle the vast acceleration in speed while attempting to pull back from a loop.

To perform the maneuver, roll to inverted flight, then pull back on the stick to perform a diving half-loop. You will finish the

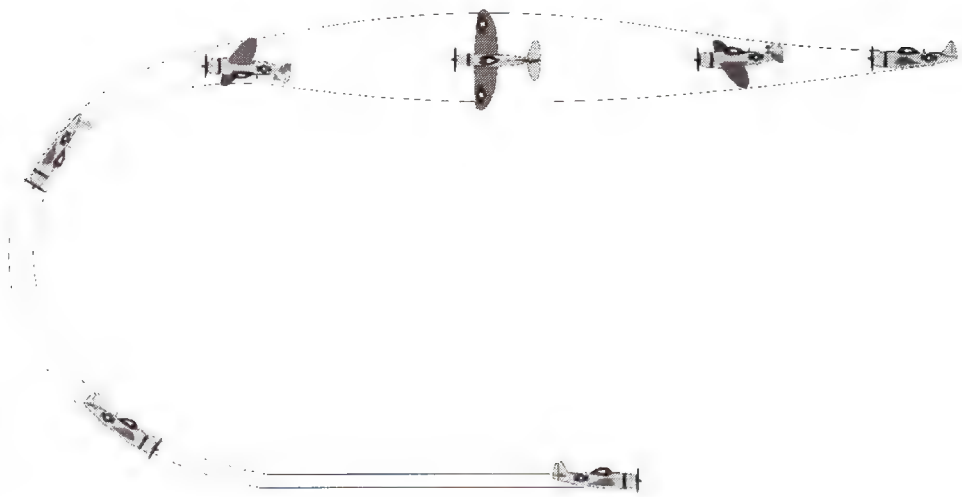


Figure 8-4
A Split-S

maneuver flying level and in the opposite direction of your initial path. The two most important factors to consider regarding the Split-S are the loss of altitude and the increase in speed.

You can generally count on losing from 1500 to 3000 feet during this maneuver, depending on your initial speed. You can also count on gaining at least 100 mph if you perform the maneuver without throttling back, which can cause serious compressibility problems when attempting the maneuver in planes such as a P-38 that are already flying at full speed. Cutting the throttle as your roll inverts can counteract the buildup of speed. The Split-S—as opposed to the Immelmann which requires a high initial velocity—can be initiated from any speed, provided you have the altitude to perform the maneuver safely.

The Split-S is very useful in engaging an enemy flying below at an opposite direction. Experience will have to be your teacher concerning how much to throttle back during the maneuver so that you do not gain too much velocity and shoot past your target and right into his gunsights.

Wingover

The wingover, also known as the hammerhead or stall turn, is perhaps the most tricky of all the maneuvers described here because of the careful timing required to make the maneuver work. Basically, the wingover is a 180-degree turn performed from a steep climb, leaving your nose to the earth and in good position to attack.

To perform a wingover, throttle up to full and begin a steep climb nearly, but not quite, vertical. Keep your eyes on your speed

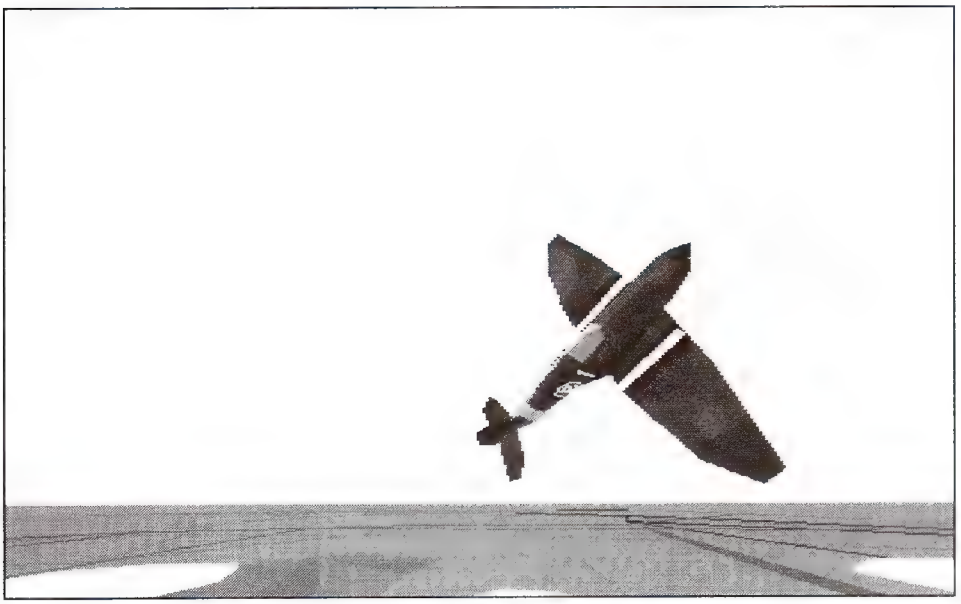


Figure 8-5

A Spitfire IX at the top of a wingover, the speed just above stall speed

indicator. When the plane nears stall speed, apply and hold full rudder (in either direction). Your plane will almost stop in flight, and the outside wing swings over (hence the name of the maneuver), turning the nose of your plane 180 degrees. As your plane wings over, the outside wing will generate more speed—and more lift—putting you at risk for a spinning stall. Careful opposite pressure on your ailerons will keep your plane from rolling. This maneuver becomes risky as you let the plane reach its stall speed because then you will most certainly find yourself in an uncontrolled spin.

As you wing over, the move is more gentle than immediate and requires some time to execute, so remain patient. This maneuver is most useful after performing a diving attack, especially on a slower flying bomber. You can use the speed of the dive to immediately initiate a second attack. Most certainly you do not want to perform this maneuver when you have someone on your tail as the drop in speed makes you an easy point-blank target and just another wartime statistic.

Chandelle

The chandelle is simply a slow turn not nearly as tight as a break that allows you to change direction as you gain altitude. Begin the maneuver from level flight with substantial speed and nose up slightly. Do not let your vertical speed exceed 200 feet per minute on your VSI. (your actual climb rate will be much faster

than this) as you use your ailerons to bank left or right. Do not use your elevators to increase your turn rate since you are still flying basically level with only a slight bank. You can, however, apply some rudder in the direction of your turn to increase the rate (too much rudder and you will lose speed).

This maneuver is too gentle to be of much use in combat, but it is useful when climbing to attempt another attack run on a bomber formation or a ground target when you're not under enemy attack.

Yo-Yo

The various yo-yo maneuvers are employed to get into attack position on a target when there is a substantial difference of speed between you and the target. They first appeared within a fighter pilot's vocabulary of maneuvers in WWII since great speed differential rarely occurred during the dogfights of the Great War.

When involved in a dogfight with an opponent, your speed with relation to your enemy becomes a prime factor in the decisions you make in order to achieve your offensive firing position. If you are pursuing an attacker and your speed is greater than his, you will overshoot if you execute a simple break turn, allowing only an instant of on-target firing. If your opponent is traveling faster, then he can simply outrun or outturn you.

Energy Management

In a combat situation, you need to be aware of two things: how to take advantage of your plane's energy, (both kinetic and potential) and determining the relative speed difference at any given moment between you and your enemy. This speed difference is a rather difficult factor to calculate empirically, and in the heat of battle you will have too much going on to observe and count and calculate. Fortunately, the sheer nature of your combat experience allows you to make some fairly accurate guesses as to the speed differential between you and your target.

The kinetic energy of your plane (as mentioned in Chapter 4) is the essential speed of your plane. The potential energy exists in several places: most notably, your altitude and your engine's performance ability. Altitude can always be converted into speed when diving, so possessing a height advantage (or at the very least altitude with which to perform maneuvers) gives you the potential to achieve greater kinetic energy. The performance of

your engine in both a power climb and level flight will tell you a great deal about your plane's ability to recover potential energy by gaining altitude or by building up kinetic energy in level flight.

Remember this basic rule: speed is always good in combat. True, there may be times when your speed is much too great than an opponent, but that disadvantage can certainly be turned into an advantage.

High Yo-Yo

The high yo-yo is a tactic rather than a set-in-stone maneuver and is aimed at placing you in an offensive position behind your enemy when you have too much speed to merely turn and pursue.

When you find yourself closing rapidly on an enemy who is not attempting straight and level flight, you can merely throttle back to gain the time you need to perform an attack. If, however, the plane is attempting to turn and evade, you will in all likelihood overshoot him if you attempt a similar turn. To perform the high yo-yo, instead of turning on your foe, pull up. The climb will bleed off speed. When climbing, apply your rudder to increase

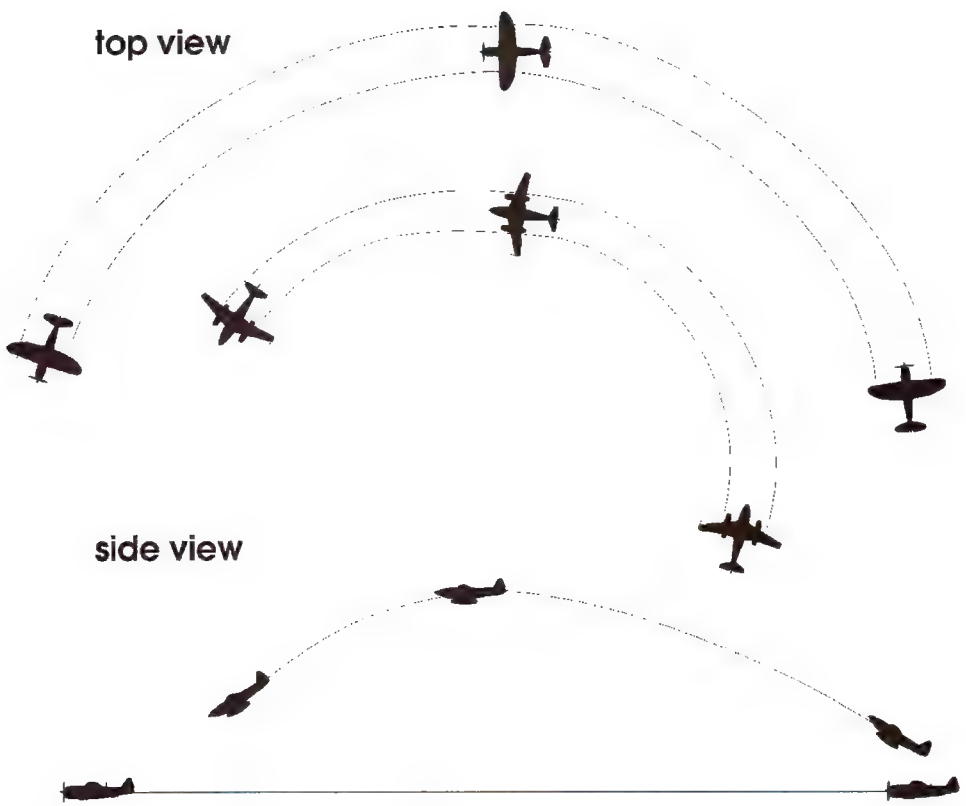


Figure 8-6

High yo-yo maneuver

your rate of turn so that you will end up with a high advantage over your target. You can then dive down on his tail for a close-range blast from your guns, performing the maneuver again if necessary.

Remember, the basic principle of the high yo-yo is to turn your excess and unwanted speed into an altitude advantage.

Low Yo-Yo

The low yo-yo is useful when pursuing an enemy who has a speed advantage over you. The basic principle is to apply a shallow dive to increase your speed so that you may close within firing range. When you have closed the gap, pull up and fire into the plane's belly, leveling off before you lose too much of your recently gained speed.

This tactic can also be applied when the opponent is turning on you. Simply execute a shallow, diving turn. Utilize your rudder to increase the turn rate and pull up inside the enemy as he finishes his maneuver, firing off a well-aimed leading burst from your guns. Performing a low yo-yo turn is an effective means of cutting the distance between your plane and your opponent, especially when initiated from a lead pursuit position.

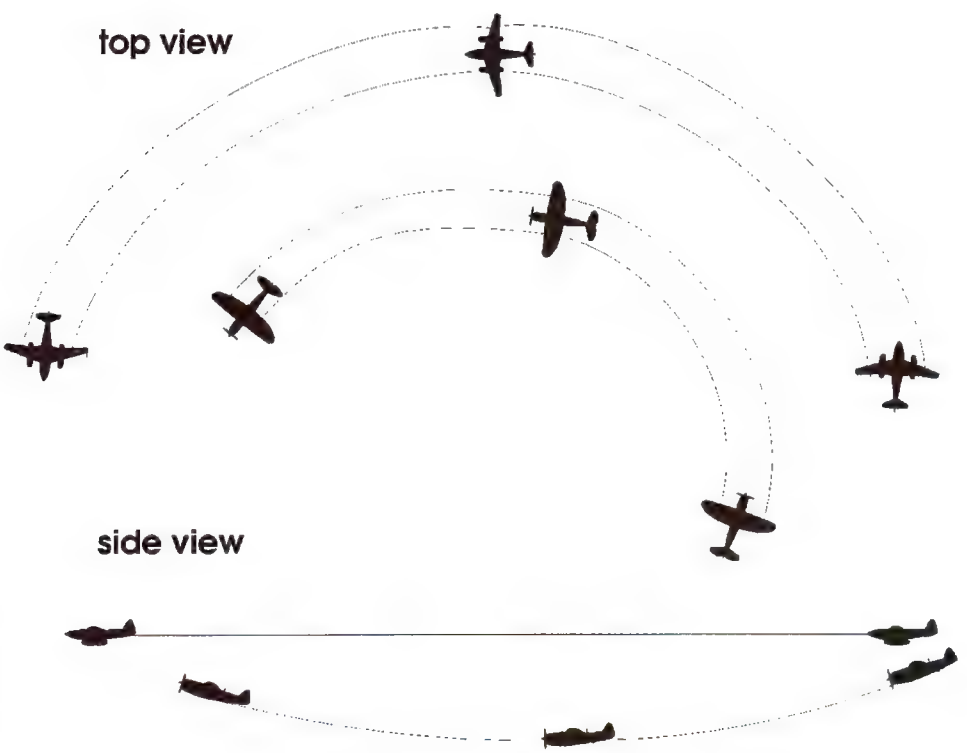


Figure 8-7

Low yo-yo maneuver

The low yo-yo maneuver can be a major key to your success in Aces Over Europe. *Utilizing the low yo-yo, you can negate the speed advantage of the faster, lighter fighter aircraft (with the notable exception of the jet-powered Me-262). A cunning pilot can employ low yo-yos to give even a sluggish Tempest a clean shot at nearly any fighter in the game.*

The Art of Detection

In aerial combat, the first move that sets the stage for the dogfight is detection of the enemy. Spotting the enemy before he spots you will place you on the offensive. Being bounced by an enemy will put you on the defensive, scrambling to evade his bullets.

The first rule of thumb for any self-respecting fighter pilot is to keep his eyes open. Make it a habit of looking left, right, and behind, always scanning for any sight of the enemy in the distance. Some planes have notoriously poor visibility to the rear, or at lower altitudes on the left and right due to obstruction from a large wing area. Pilots of the Arado had to look behind through a tank periscope and have said that when they could see the enemy back there, it was already too late.

Aces Over Europe provides you with one advantage the fighter pilots did not have, and that is the External view. Tapping the Enter key toggles you between the Internal and External views, and pressing F1 through F6 in External view (or you may rotate your view using your controller—see Appendix D) will let you observe the surrounding airspace without the obstructions found within your cockpit. The Chase Plane view (F7) allows you to follow your plane from behind (the Chase Plane will execute the same maneuvers as your plane with a 1.5-second lag).

Utilizing all of the views available to you will allow you to spot the enemy approaching as soon as possible. *Checking your six* is a term to describe automatically checking behind you every few seconds to see if you have an enemy on your tail. This is especially important when you are in the midst of a multiplane dogfight because it is easy to have your attention focused on chasing down one bandit while another sneaks up from behind and peppers your plane with machine-gun fire.

Remember that the air is filled with natural hiding places such as clouds and the sun. *Aces Over Europe* simulates glare by washing

your view in yellow if you are flying into the sun. If you have the Sun Blind Spot option checked in the Realism Panel, (Alt-R), then an enemy plane may be hiding behind the sun's glare and become invisible to you.

The last thing you want in *Aces Over Europe* is to have your wing surprised by a gun-blazing horde of bandits when you least expect it. On the other hand, gaining the initiative by surprising an opponent is one of the best ways to come out of a dogfight alive.

If you have the opportunity, utilize the natural shield of the sun as you approach an enemy flight: keep yourself between the sun and the enemy. Once you have achieved a surprise approach, do not forget to attempt an altitude advantage so that you can have a quick buildup of speed at your disposal if the enemy spots you and begins evasive tactics.

You can also use clouds to sneak up on the enemy, but remember that your visibility will be hampered along with that of the enemy. You will need to fly just beneath the surface of the clouds so that you can bob up and check your progress from time to time.

Closing in for the Kill

Once you have spotted the enemy, you might close in for the attack. The first order of business is to determine as quickly as possible what type of opponent you are facing. Is the enemy faster

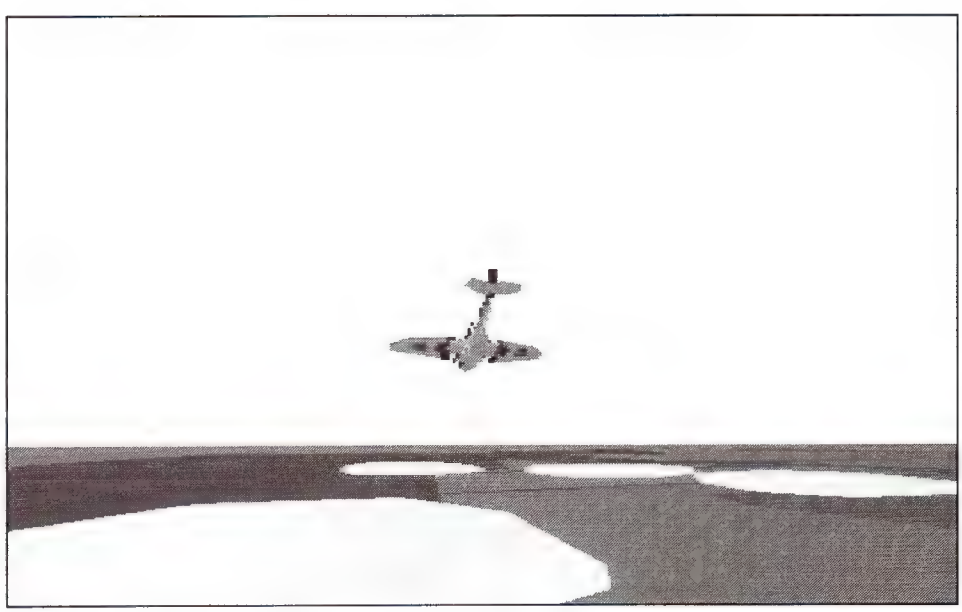


Figure 8-8

The clouds and sun both can be utilized to achieve an element of surprise.

or more maneuverable than you are? Who possesses the offensive and defensive advantage? Answering these questions before you come in with guns blazing will help you develop the proper strategy for the engagement.

If the opponent is more maneuverable but you possess a speed advantage, then gaining altitude and utilizing hit-and-run attacks is your most prudent strategy. If your plane is more maneuverable, then getting in close and mixing it up will serve you best. Having a plan in mind before you engage will allow you a few seconds of precious time to set up for the type of attack that will work best.

If the enemy plane or flight is still some distance off, you will also need to determine its general direction of flight. Simply coming in from behind will be the best tact when you have a level speed advantage. If you do not, then climbing to a height several hundred to 1000 feet above his plane of flight and turning to perform a diving intercept attack is the way to go.

The pilots you will face in *Aces Over Europe* will rarely run from you even if outnumbered, so rest assured that even a distant flight of four FW-190s will come around to say hello.

When closing in on an enemy from a distance, make your angle of approach fit your desired strategy. If you need more time, fly parallel to the enemy and let him come to you. If you have everything prepared, lead his flight by coming in at a tighter angle.

When you are involved in a dogfight and need to intercept a single plane from long range, use your eyes to keep tabs on his turns and banks. At a greater distance, you can turn inside of your opponent and close the distance very quickly. If you determine a speed discrepancy, perform a yo-yo maneuver to adjust your speed. Remember to think offensively and always close in on a target or evade a target with the ultimate goal of putting a dead-aim burst of gunfire into his fuselage. Let that goal guide your interception tactics.

Aerial Gunnery Skills

Once you get in close and mix it up with your target, you want to make sure that your shots count. This will require good aim, a steady hand, and knowledge of the basic principles of aerial gunnery (and, of course, some ammunition still left in your guns).

The simplest and most effective shot to take on an enemy is when you are riding his tail close enough so that the tips of his wings fill your entire sight. You are traveling the same direction

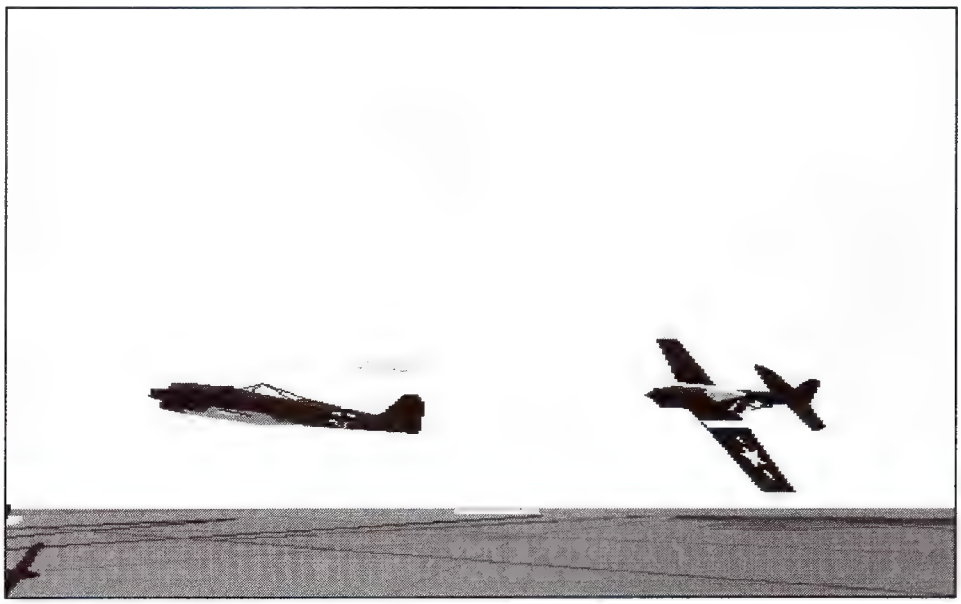


Figure 8-9

Close on the tail of an FW-190A, a P-51D fires full guns.

and have time to aim, giving you the luxury of laying in a longer blast than from any other angle.

Of course, as is true of most things in the real and simulated world, opportunities that are easiest are also rarest. In a dogfight, both you and your opponents are moving. Each of you desires to get in an advantageous shooting position and avoid the other's bullets.

Often you will find yourself facing a head-on attack from an enemy. While this is still a straight-on shot requiring no leading, the closing speed of the two planes will be extremely fast and, of course, he will be shooting at you. If you already know what type of opponent you are up against, then you will also know whether or not to accept a head-on opportunity. Flying into the blazing guns of an enemy ace could be an act of suicide. If a head-on pass is too risky for your situation, dive quickly and regroup.

Deflection Shooting

The vast majority of the firing opportunities you will encounter will require deflection shooting. You opponent will rarely fly in a neat line directly in front of you—more likely he will be breaking and turning and trying like hell to get away. You will need to become adept at the instinctive art of deflection shooting, which is knowing how to lead your shots. If you are flying straight and level and an opponent cuts across your nose breaking left and

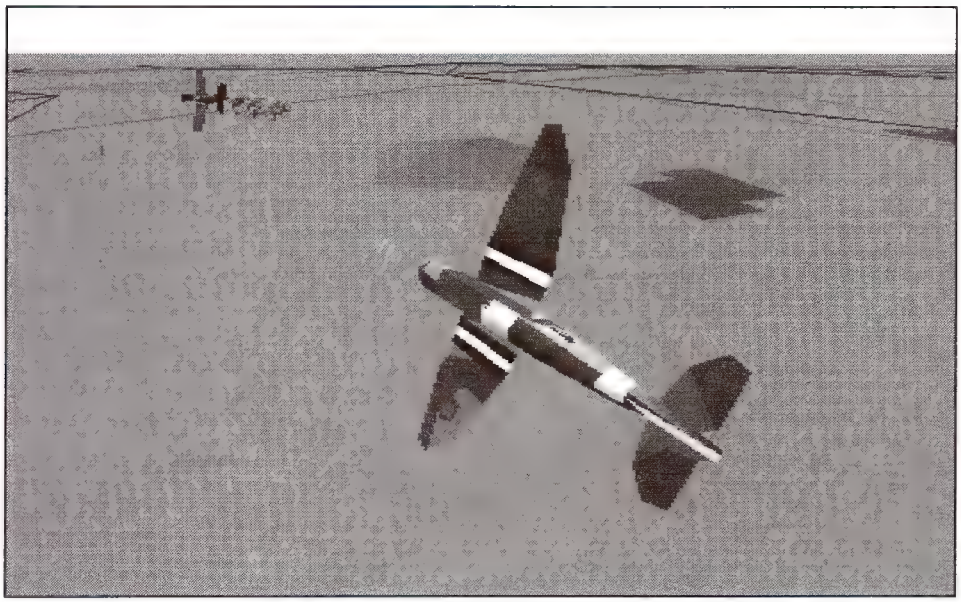


Figure 8-10

Firing while in a tight turn will necessitate leading your target. This is called deflection shooting.

you turn to follow, you cannot simply aim at his tail. Since both of you are turning, he will no longer be at the point he was when you fired. To compensate for this, you will have to lead your shots, which means firing in front of your target so that he will fly into the bullets.

A zero deflection shot occurs either on a head-on pass or when you are following your target and means that your aim will be straight ahead. High deflection shots occur when your target is flying a path nearly perpendicular to your own flight path. This is the most difficult type of shot to accomplish since you will have to lead the planes precisely. The vast majority of situations occurs somewhere in the middle range, with the target's path intersecting yours from a 30- to 60-degree angle. When firing, you will aim just past the nose of your target. How far ahead to aim is based on many factors: the actual angle of deflection, your respective speeds, and the range from which you are firing. There are no hard and fast rules to calculate how much to lead the plane, but it is a skill that will eventually become second nature. Just remember to be aware of the variables affecting your aim and do your best to compensate for them. Beyond that, aerial gunnery enters the realm of instinct.

Range and Drop

Firing from extremely long range is an exercise in futility. Don't waste your bullets. The effective firing range of your plane varies

with the armament you are utilizing, but do your best to keep your shots down to medium or short range. You'll rack up more kills and your ammunition will last longer.

You will need to observe the drop in your bullets over distance. At extremely close ranges, bullets fly straight for all practical purposes, but this is not the case at the longer ranges. Gravity will transform your bullet stream into a gentle parabola, and you will need to aim slightly higher the farther away your target is. This, like deflection shooting, will eventually become second nature to you.

Ammunition Management

Just after dropping two Bf-109s you can feel pretty elated as you fly high above the European countryside, but that elation can turn to terror if you are bounced by a flight of Focke-Wulfs and you are out of ammunition.

Your plane is equipped with a set amount of ammunition, a restriction that you must learn to live with. Planes such as the Bf-109 are notoriously stingy with their ammunition loadout while a P-51 will provide you with a lot of firing duration.

You will need to keep an eye on your ammunition counters as you fight. At certain times—such as a high-stakes, two-against-four dogfight—switching to Full Guns can give you the extra punch you will need, but ration your ammunition wisely. Do not fire in long bursts of more than 2 to 3 seconds, and don't waste bullets on targets beyond your aiming range. When intercepting bombers, use your cannons for the heavies and save the machine guns to deal with the escorts that will inevitably show up. You will also need to consider just how deep into the mission you are. A dogfight before you reach you primary mission goal will necessarily require stingier ammunition usage than an enemy flight encountered on the way home.

Damaging Your Opponent in Aces Over Europe

The planes of *Aces Over Europe* are constructed of a certain number of boxes, with the number based on the size and number of engines on the plane (bombers have more boxes than fighters). These boxes roughly correspond to key damage locations on the planes, such as the engine and fuselage. Each box can take 1024 points of damage. When a box is destroyed, the plane is considered shot out of the sky.

Table 8-1 Per-Bullet Damage from the Aerial Weapons in Aces Over Europe.

WEAPON	DAMAGE POINTS[a]
.303 caliber MG	10
.50 caliber MG	20
13-mm MG	15
15-mm MG	20
20-mm cannon	100
30-mm cannon	150
57-mm cannon	600
USAAF rockets	10,000
Gr.21 rocket mortars	1000
R4M rockets	1333

[a]These figures are fairly accurate when you are attempting to shoot down an airplane; i.e., two hits in the same location with a 57-mm Mosquito cannon will destroy any airplane. The damage numbers become more abstract when you attack ground targets because each ground target has a certain resistance to damage—or armor value—that decreases the points of actual damage applied to that target's box.

The various weapon types will inflict a set amount of damage for each hit, and the damage sustained in each box is cumulative and stored in that plane's box list. In addition, each hit on a box has the potential to create a critical-hit situation, inflicting substantially more damage than the bullets alone normally would accomplish (see Table 8-3 for critical-hit information).

It is easy to see, then, how concentrating your fire on a specific location will destroy an enemy faster than bullets strafing over the entire fuselage. Also, since the damage each plane receives is permanent while in the air, you can and should break off an attack if another target presents itself and return to the original target if another opportunity permits.

Evasive Tactics

As distressing as the thought is, you will be forced to play the defensive role many times throughout the missions you will fly in *Aces Over Europe*. The primary goal of defensive flying is survival. If you find yourself on the receiving end of a stream of bullets, you will need to take immediate action to get out and get out fast. If you are being tailed and still have some time, you may

radio for assistance, sending the Clear My Tail message over the radio.

If you do not have the luxury of time, then evasive maneuvers must be taken. The most common and useful evasive maneuver is the break turn, but remember to break toward the defender rather than away. This will give your enemy the least time to get off a shot. If you break away, it is academic that your defender will simply perform a slight bank and be breathing down your tail in just a matter of seconds.

Direction-changing maneuvers such as the Immelmann or Split-S are also useful for getting out from under the gun. Generally, the Split-S is preferable if you have the altitude since the Immelmann will bleed your speed away (and will leave you vulnerable to enemy gunfire).

Knowing your plane's strengths is key in getting out from under enemy fire. If you have a plane that can climb more rapidly than your opponent's, then climb out of harm's way, meanwhile building up that all-important potential energy. On the other hand, if you are flying a heavy plane such as the P-47, an evasive climb is an invitation to an early 21-gun salute. Instead, dive away from the attacker.

The hard skid is another solid tactic to throw off your opponent's aim. Remember, though, that situations change fast in a dogfight, and you will need to consider your next maneuver while you are performing your skid or the enemy will bear down yet again.

If you can get between your opponent and the sun, then you will have bought yourself a few precious seconds to regroup. If clouds are nearby, a dive into the murky whiteness will render you invisible and can set the stage for a timely withdrawal or provide the necessary time to regroup for an attack.

As in all battles, there comes a time when flight rather than fight becomes the only course of action. As a fighter pilot, you must know when you have been beaten, when the odds are simply stacked beyond your control and it is time to turn tail and get out of there.

Most planes possess some advantage when escaping the scene of the battle, whether a fast, controlled dive or a power climb. Utilize your plane's strength and any natural advantages such as the sun or the clouds to make your way from the scene of the

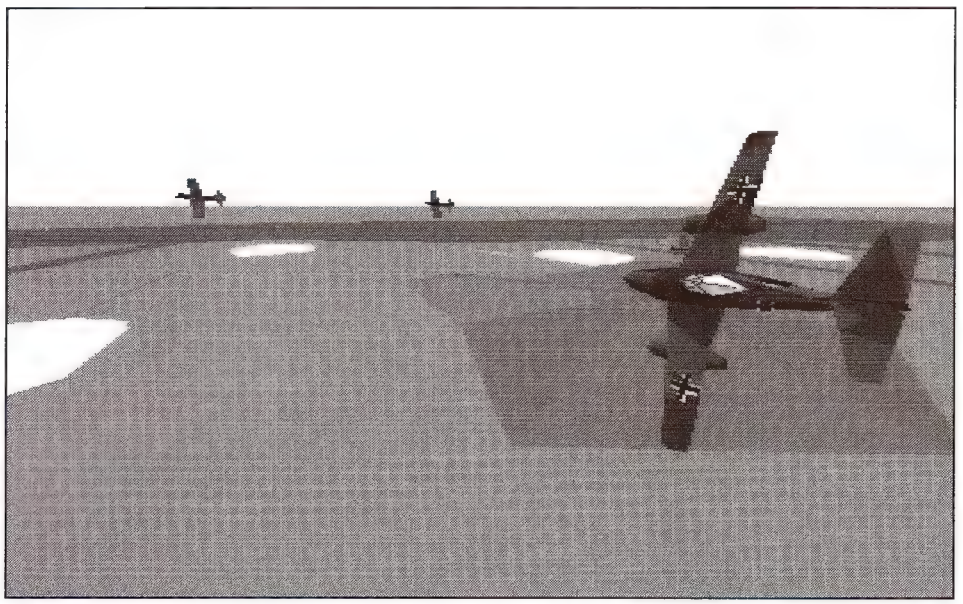


Figure 8-11

A Mustang pursued by the Luftwaffe's twin-engined jet, the Me-262

battle. Always remember it is better to live to fight another day than to allow the enemy the opportunity to take you out of action for good.

When flying against the Me-262, you will always be at a disadvantage during an escape attempt, because an Me-262 can always fly faster than any other plane. Rest assured—given the time, the plane will catch up.

There is a strategy, however, to turn the tide in your favor. Dive down rapidly to low altitude, perhaps only a few hundred feet. If the Me-262 is right on your tail, he very well might have too much speed to pull up and he'll end up peppering the French landscape with jet turbine blades.

If the Me-262 is still there, slow down your flight to 200 mph or less and keep low. The Me-262 struggles at low speeds, and you will have evened the odds considerably. Also, the Me-262 is notoriously slow to accelerate when moving below 300 mph, so you have chalked up another advantage in your column.

Dogfighting: Attacks against Fighters

The many maneuvers and situations outlined above can leave you with the feeling that dogfighting is a regimented and inorganic practice. Actually, nothing could be further from the truth. All of the skills and acrobatic abilities mean nothing if a fighter pilot cannot adapt them to the changing situations in an aerial battle.

True, a pilot must learn the basics, must be an expert flyer and accurate marksman; but it is the instincts, intuitions, and creativity of a pilot that are the foundations of becoming an ace.

Practice all you can, but do not ever be afraid to experiment. Keep your eyes open and your mind constantly working, reevaluating the situation every chance you get. In a way, a dogfight is like a chess game—a strategic battle between adversaries—but it is a chess game with rules that are meant to be broken. Performing the unexpected can yield an advantage.

On the other hand, although a dogfight may progress in discrete steps, it is not played out in moves. There are times when a situation such as riding down the tail of a P-47 takes precedence over everything else. Every neuron of the pilot's attention is focused on taking out that particular plane at that particular moment. In that way, the dogfight becomes much more visceral, a true combat between doggedly determined adversaries.

When taking on other fighters, be sure to take stock of the situation and catalog your advantages and your weaknesses. Beyond that, the battle should become an improvisation. Like a musician playing within a certain key, you are following general rules and principles but you are letting your instincts guide your actions and reactions as you work within the situation.

Flight skills can make a world of difference, separating success from failure, and the physical constraints of your plane may hamper or empower you; but it is the ebb and flow of your decisions that will truly win the battle for you.

Attacks against Bombers

Intercepting and bringing down bombers will be a major emphasis of your missions, especially if you are flying for the Luftwaffe. Unlike fighters, who can dodge and weave with you, bombers are slow, clumsy machines, not capable of evading your nimble fighter in the slightest. At best, their evasive weaving can foul your aim for a moment or two; but since the target area is so huge, it does not present much difficulty.

What abilities, then, do the bombers have at their disposal? First, the bombers will generally be accompanied by fighter escorts. Second, the bombers are armed with a dangerous allotment of defensive firepower. As you experienced in previous missions, getting in close and taking out a bomber while remaining unharmed is a tricky proposition.

If you encounter fighter escorts when charged with intercepting bombers, you have two basic courses of attack: either you engage in a dogfight with the fighters or you head straight for the bombers. Luftwaffe pilots generally chose the second option in the late war, in part because of their desperate situation and in part because they knew that their planes were at best only an equal match against the Allied escorts. It would be risky to devote too much time to a dogfight when the odds were not in their favor. Which tactic you employ depends largely on the situation and your own flying skill.

As far as taking out the bombers themselves, there are several solid ways to attack. In the last chapter you performed a high-side attack against a formation of B-17Gs. You also learned about the dangers inherent in a stern attack, allowing yourself to be an easy mark for the turreted rear guns of the bomber.

Head-On Attack

One of the most effective tactics for taking out a bomber is the head-on attack. As its name implies, this is essentially a joust with a 10-ton beast. You fly straight in toward the target, descend from a shallow dive, and pepper the bomber's nose with fire before diving down through the formation. This attack is effective because you can deliver the most firepower to the most vulnerable area of the bomber: the cockpit. It is tricky since your closing speed is extremely rapid and the time you have to aim and fire is counted in seconds.

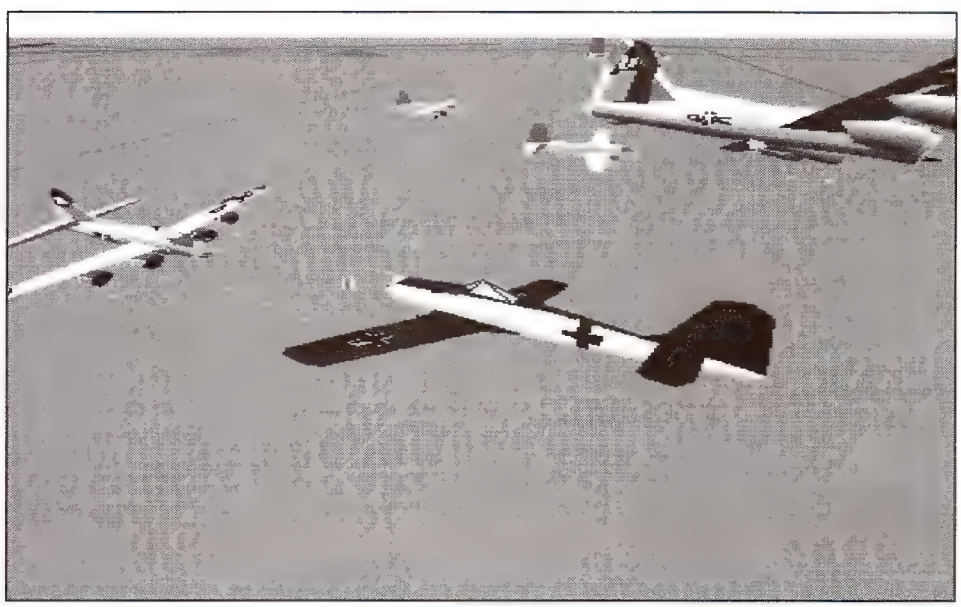


Figure 8-12

An FW-190D performing a head-on joust against a B-17

To initiate this attack, fly parallel to the bombers, gaining an altitude advantage, and allow your plane to overtake the flight. When you have gained a significant lead, turn into the stream and execute your attack, completing the maneuver by diving through the formation and breaking to avoid the defensive fire.

Stern Attack

While attacking the rear of a B-17 from level flight can rightly be called an exercise in widow-making, executing a stern attack from a dive can be an effective approach. By gaining a substantial altitude advantage and targeting a bomber in the rear of the flight, you can dive down quickly and deliver fire with out risking an inordinate amount of time within your enemy's gunsights.

The stern approach will give you more time to aim and shoot than the head-on pass, but you will still be vulnerable to the bomber's defensive fire. After diving down past the bomber, be sure to break away before you find yourself flying under the bomber formations and being blown full of holes.

Overhead Pass

The overhead pass is perhaps the most difficult but also the most deadly attack on a bomber. Performed from an altitude at least 1500 feet above the bombers, the fighter dives down and targets the top of a bomber between the wings, diving through the formation before the enemy gunners have a chance to hit the rapidly moving target.

Figure 8-13

An Me-262 coming in from the rear

Performing the maneuver when flying parallel to the bombers requires a setup much like that for the head-on attack; however, here you will want to gain a significantly more substantial altitude advantage. When in front of the bomber flight, turn 180 degrees and roll inverted. You should be traveling over the bombers in the opposite direction. Using the Forward and Up view, gauge when you have just passed the formation and then pull the stick back. Perform a truncated loop that will leave you in a steep, fast dive coming in on the stern of the bombers. Target and fire as you blast through the formation, and then break away. Use your speed to climb up again to set up for another pass.

When performing the maneuver while approaching from the opposite direction, turn 180 degrees as the bombers pass you, then roll to inverted flight. You should now be flying in the same direction just slightly ahead of the forma tion. Pull down into a dive and execute a high-speed, head-on attack before breaking away from their defensive fire.

Remember to give yourself at least a 2000-foot cushion below the bombers to pull out of the dive.

Group Tactics

The dogfights of the Second World War were rarely solitary affairs, but instead brought together combatant flying in mutually protective groups. Distilling the formations to their most elemental state, a pair of planes would work together: one as a leader, the other as the wingman. Flying just behind the leader, it is the wingman's job to watch out for enemies approaching from the rear. The leader selects and engages the target with the

Table 8-2 Radio Commands Issued to Your Wingman in Combat

KEYSTROKE	COMMAND	NOTE
F1	Clear my tail!	A call for help if you are being attacked
F2	Bandits, break left!	Tells wingman to break left hard
F3	Bandits, break right!	Tells wingman to break right hard
F4	Get on my wing.	Tells wingman to reform on your wing
F5	Attack freely.	Releases wingman of duties
F6	Attack the…	Additional menu follows providing choices

wingman also attacking when the situation permits but remaining faithful to his initial duty. Flying in pairs, it was possible for pilots to become more aggressive fighters because for protection they were bound to another plane.

In *Aces Over Europe*, the two-plane wing is the foundation unit of fighter tactics. Flying a mission as a wingman, it is your responsibility to stay with your flight leader and watch his tail. Never break away unless he radios for you to do so. If the call comes in Clear My Tail, drop everything and return to assist.

If you are flying as the flight leader, you and your wingman make up one section of the flight, and the other two planes (if there are any other planes) make up the other section. You can control your flight by using the radio, addressing either just your wingman, the other section, or the entire flight.

While you can issue specific orders to your wingman during a dogfight, you can only issue general orders to the entire flight of the other section. After all, it is not in your authority even as a flight leader to issue orders to another section's wingman.

By setting up a Dogfight a Squadron mission, you can get a good feel for how the wingman dynamic works. Start the mission (any setup will do), switch to an External view looking down on your plane, and zoom out ([ ]) until you can see the entire wing. Now, try issuing radio orders to the entire flight—the other section and your wingman—to see the results. You can also maneuver left and right to watch how your wingmen attempt to stay with you.

When flying missions for the Luftwaffe, there will be occasions when you are forced to perform with the help of only a single wingman and no other planes. Rarely will you be asked to fly a mission solo with no protection whatsoever.

By maintaining the integrity of your section as a wingman or by issuing the proper commands as a flight leader, you can fully utilize the offensive abilities of your entire flight and increase the chance for the success of a mission and for your own survival.

When you are flying as a flight leader, *Aces Over Europe* allows you to select the formations that your planes will hold throughout the mission. When flying for the Allied services, you have the choice of setting up six different formations: Vee, Line Astern, Line Abreast, Echelon Left, Echelon Right, and Finger Four. When flying for the Luftwaffe, you have the choice of three

(depending on the mission circumstances) formations: Rotte, Kette, and Schwarm.

The most useful and flexible formations are the Finger Four and Schwarm, which are very similar. First developed by the Luftwaffe after their experiences in the Spanish Civil War, the Schwarm formation is made up of two, two-plane units, each known as a Rotte. It was designed to achieve maximum visibility and to provide the ability to react quickly to combat situations. The lead plane was shadowed by his wingman on the left, and the second Rotte (made up of a section leader and a wingman) flew at the flight leader's right.

The Finger Four was derived from the Schwarm and became common practice for RAF pilots during the Battle of Britain when their traditional tight formations became a liability rather than an asset. The Finger Four is so named because the planes fanned out as if at the fingertips of an imaginary hand (not

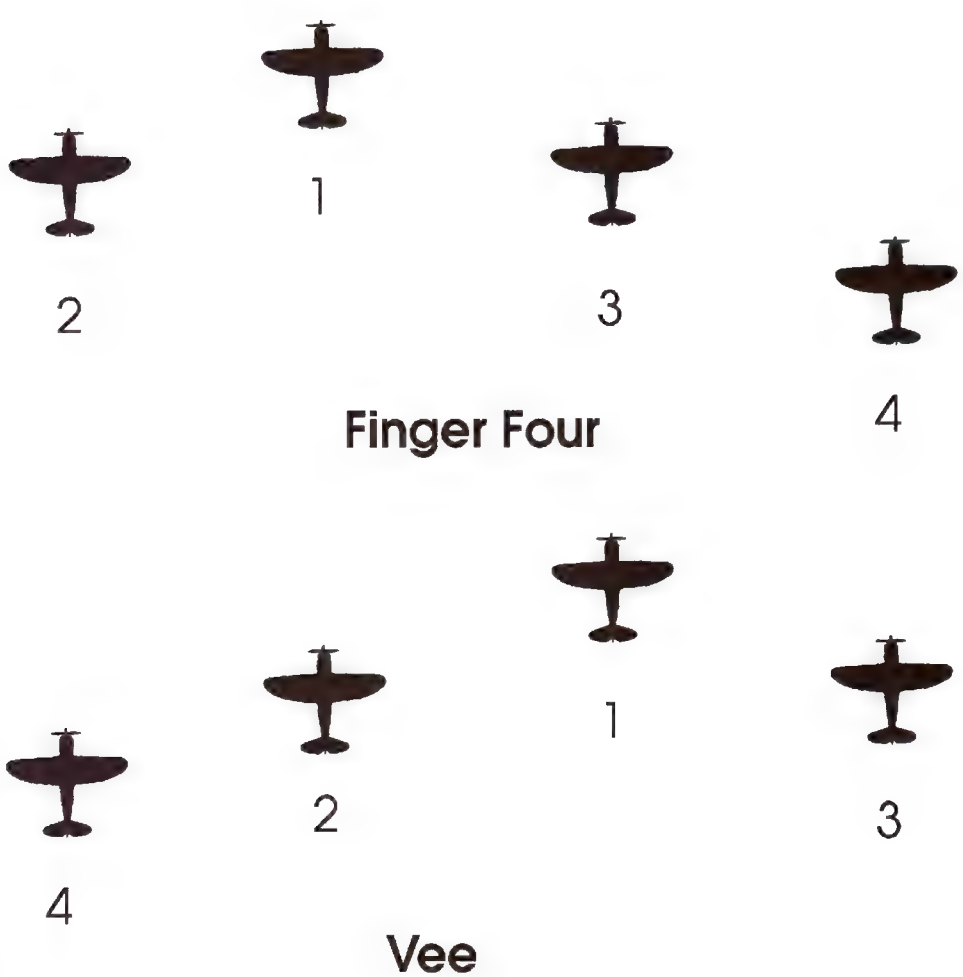


Figure 8-14

Allied Finger Four and Vee formations

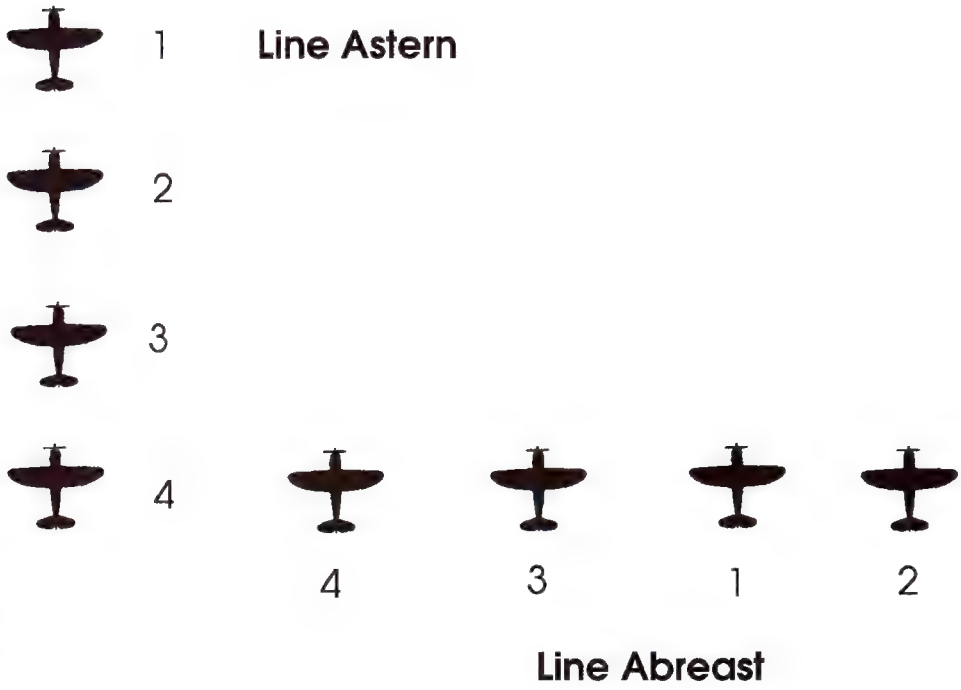


Figure 8-15

Allied Line Astern and Line Abreast formations

including the thumb). The Vee is a more constrained variation of the Finger Four, weighted to the opposite direction.

The Luftwaffe Rotte and Kette formations are available when flying a mission with just a pair of planes. Rotte has the wingman flying to the right and behind his leader while Kette has the wingman flying to the left and behind.

The other Allied formations are more rigid and less flexible and are generally more useful in ground-strike missions. You may select the flight formation from the Preflight Options screen only before a mission starts; you may not alter the formation while in the air.

From the Journal of Gerhardt Lichter

1st Lieutenant; August 1, 1944

...the doctor has set my bone. Although it itches, the pain has dulled. I have been assured that even though I aggravated the break by walking to the farmhouse, I will be back into combat before the month is out.

The patrol from Ursel seemed so much like the one the day before and the day before that. The sky was gray with clouds and we saw no one. Then all at once, two Americans raced from the clouds. I issued orders for my wing to attack, of course, for the glory of the Reich. Two Americans in their fat little Thunderbolts would be an easy target. I

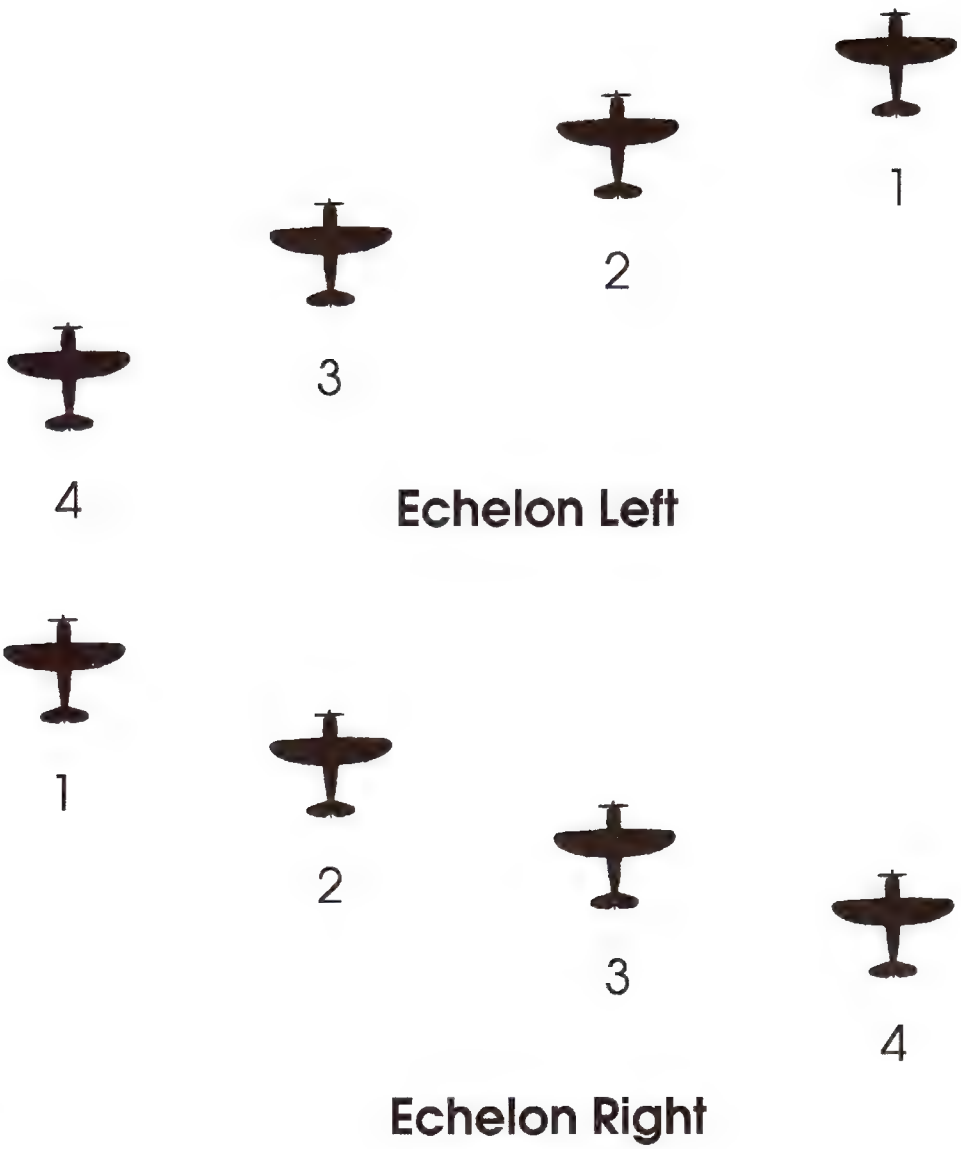


Figure 8-16

Allied Echelon Left and Echelon Right formations

broke left to follow one and he dove down, performing a Split-S so obviously that I had to follow.

I pulled up, gaining of course, when there was another, suddenly firing into my windscreen. I broke left. They had tricked us! The first American looped under again, but this time I checked my tail before I followed. Then I pulled back and armed my cannon as I let him have it. My tracers went like an arrow, filling his cockpit. Then in a ball of flame, I knew he was dead.

I jerked around, and another was on my tail. I radioed Stadt to cover my tail but he was too far off. I should not have been so cavalier. I broke left then right, turning as tight as I could manage, and I could see through my canopy that I was gaining. I could smell the heat from the engine, but it would only be a moment before he was in my sight and would become my fifty-third kill. Just another inch and my index could already feel the trigger through my glove—then bullets everywhere!

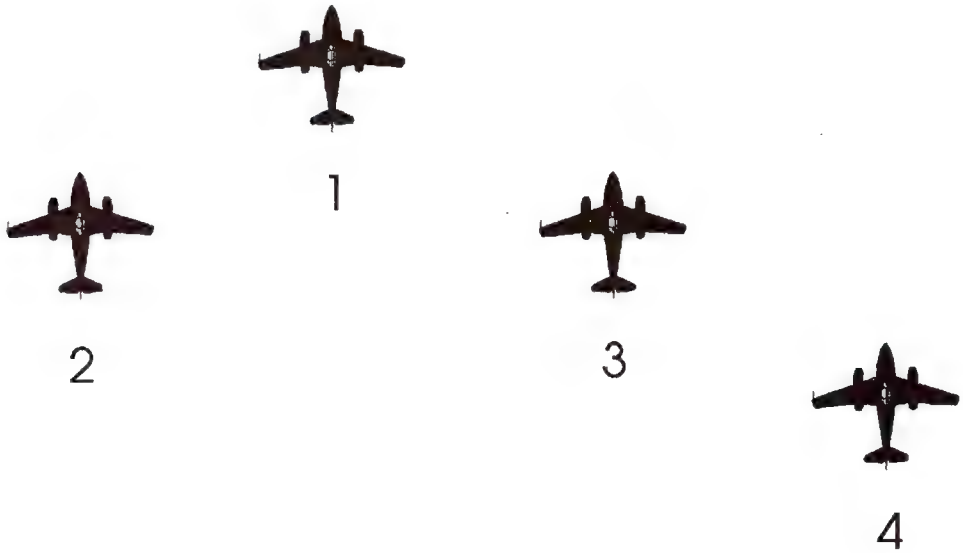


Figure 8-17

Luftwaffe Schwarm formation

Another American flying head-on, and every shot hit. In a moment, I could feel the plane give up as if shrugging her shoulders, her life now done. I began to fall, not too hard a spin and not too fast. Above I could see the two Americans regroup as I blew the canopy and tumbled free of the plane.

It was odd how the air smelled of burned oil. As I fell, I watched the plane below. The parachute jerked tight. Through my foolishness, I had let the Reich down. I hoped that Stadt would not be so stupid...

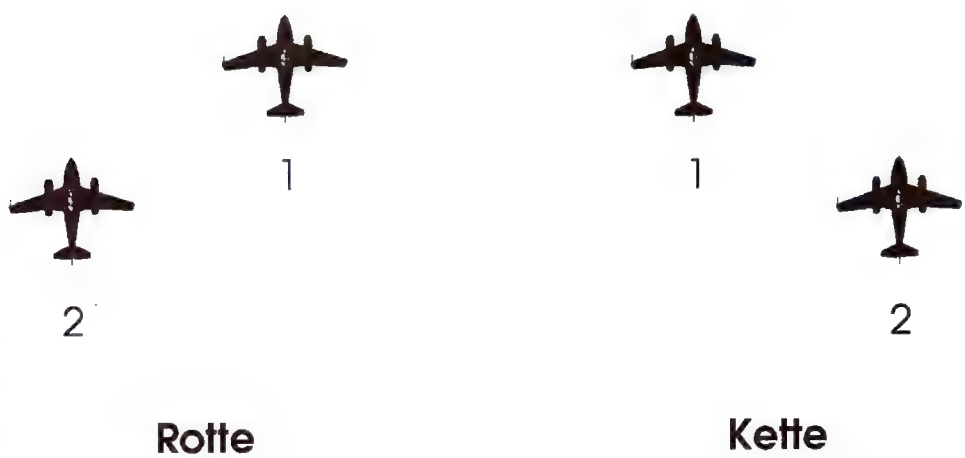


Figure 8-18

Luftwaffe Rotte and Kette two-plane formations

Taking on an Ace—Reprise

In Chapter 2, you went face to face with Pips Priller using the superior turning ability of your P-51D Mustang to cut inside of his Focke-Wulf 190A and blast him out of the sky. Now that your flight time is significant and you have a far greater range of abilities, perhaps it is time to attempt a more challenging fight.

FLY SINGLE MISSION: DOGFIGHT A FAMOUS ACE: U.S. ARMY AIR FORCE: GEORGE PREDDY

The first time you set up this mission, give yourself a bit of an edge by selecting the FW-190D9 as your plane, and give yourself the advantage of surprise. To make your over-the-channel duel more interesting, select Mostly Cloudy for the atmospheric conditions. You can tell from the mission title that you are flying against George Preddy.

Once in the mission, immediately choose Full Guns (since you only have one opponent, conserving ammunition is the least of your priorities) and scan the area for a sign of Preddy. You should see his Mustang several hundred feet below you as it breaks right across your flight path. Nose your plane down and begin the engagement.

If you haven't flown the 190-D previously, you will be pleasantly surprised by its speed and maneuverability. It's able to consistently turn tight enough to cause you to black out. When your screen begins to dim, ease up on your stick to lessen the *G*s. Your head will clear soon, and vision will return to normal.

Preddy was a pilot who did not like playing the defensive role. He was used to his Mustang's ability to outper form the vast majority of his opponents. If you can manage to get on his tail, his flight abilities lessen considerably. Keep back to medium-close range; that will allow you enough time to anticipate his maneuvers and throttle up or down to match his speed. He'll try to get away; but if your reflexes are true, you should be able to gun him down.

Major George E. Preddy, Jr.

Major Preddy was perhaps the greatest of America's Mustang aces, shooting down 28 German aircraft between December 1943 and December 1944. He flew both the P-47 and the P-51, initially with the 487th Squadron and then as commanding officer

of the 328th Squadron of the 352nd Fighter Group. On August 5th, 1944, Preddy accomplished what no other Allied fighter had done: within the span of 10 minutes, he downed six Bf-109s by coming up from behind a formation of 30 planes. Many think that Preddy could have been America's top scoring ace had he not been tragically shot down by friendly flak on Christmas Day 1944.

Preddy worked with the USAAF in preparing training documentation for upcoming pilots and offered these words of advice for bomber escort missions:

> *Normally, flight leaders and [section] leaders look for bounces with the wingmen on the defensive. This doesn't mean that leaders never look back or wingmen never look down. It is impossible to see everything, but each pilot must keep his head moving and look to find. If a pilot sees an enemy aircraft behind him in firing range he must take evasive action immediately. He slips and skids the ship as much as possible, giving the Hun maximum deflection. It is a good idea to turn in the direction of friendly planes, so they can shoot or scare Jerry off your tail...in escorting bombers, it is a good idea to range out to the sides, front and rear, and hit enemy fighters before they can get to the bombers.*

Once you have shown your mettle against Preddy in an FW-190D, set up the mission again. This time accept the default

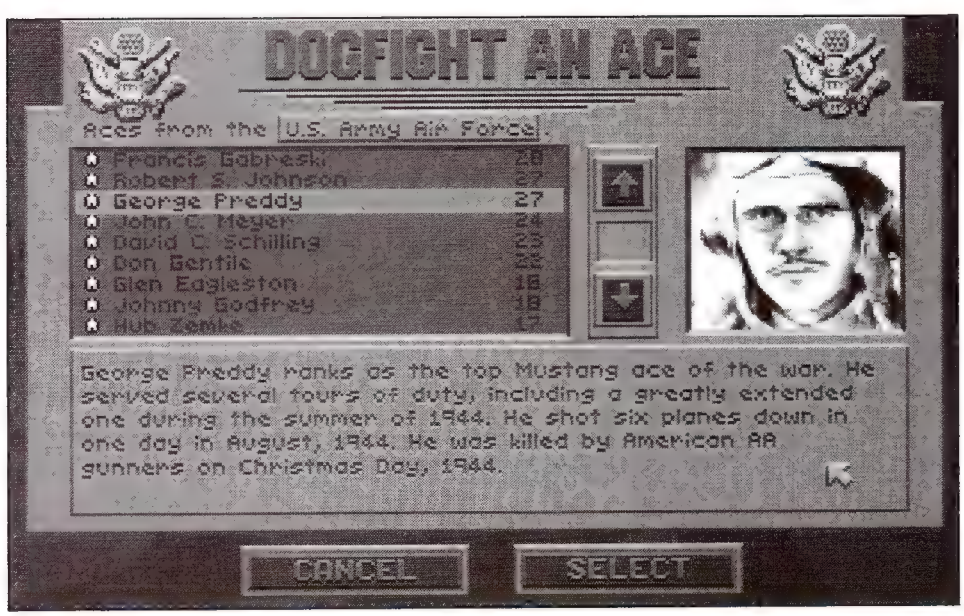

DOGFIGHT AN ACE
Aces from the U.S. Army Air Force:
Francis Gabreski 28
Robert S. Johnson 27
George Preddy 27
John C. Meyer 24
David C. Schilling 23
Don Gentile 22
Glen Eagleston 18
Johnny Godfrey 18
George Preddy ranks as the top Mustang ace of the war. He served several tours of duty, including a greatly extended one during the summer of 1944. He shot six planes down in one day in August, 1944. He was killed by American AA gunners on Christmas Day, 1944.
CANCEL
SELECT

Figure 8-19

Major Preddy from the Ace Selection screen in *Aces Over Europe*

assignment of the Bf-109G, with no surprise advantage and clear skies all around. You begin the mission heading straight at each other, and you can bet that Preddy will come out firing.

As you mix it up, you will notice that Preddy likes to remain below you. He knows that his plane can climb to meet you. By circling several hundred feet below, he can utilize his Mustang's bubble canopy to keep you in sight at all times. This can be especially frustrating for you. His plane has every advantage and if you utilize only your cockpit view, he will remain practically invisible until he rises to strike. Also remember that once he is on your tail, he can lay in quite a few deadly bursts before you can slip away.

Try to remember to employ evasive tactics if he is coming in for the kill and remember that you have one advantage over him as he circles below: the potential energy of altitude. You might try rolling inverted so you can see him. Then when he begins a favorable break, pull back on the stick to initiate a steep diving attack. Just remember to get out of there and set yourself up again, shaking him from your tail at all costs.

Flying against Preddy when you are forced to deal with an inferior plane will give you a good idea of just how deadly a skilled pilot was in a P-51D and why Preddy became an ace.

Emergency Procedures

At some time in your flight career, you will be forced to deal with a damaged aircraft. In some cases, even a wounded plane can be an effective weapon—but then only for a limited amount of time. When your plane is damaged, the best strategy (especially if you are flying a career series of missions) is to get out of the conflict. Diving away can give your plane sufficient speed to possibly escape even when dealing with a damaged engine.

As you attempt to hobble home, try to utilize autopilot to get back to your base. Autopilot will not work if your plane is so damaged that the flight time required is longer than the life expectancy of your wounded plane. If you engage autopilot when you have a fuel leak, it will disengage when your fuel runs out.

If autopilot is not available due to enemy presence or the damage level of your plane, get low to attempt an emergency landing. Bringing up the map (M) will let you know if you are flying over friendly territory. If at all possible, get into friendly airspace before

Table 8-3 Critical Hits a Pilot May Experience in Aces Over Europe

DAMAGE	CAUSE	NOTE
Oil Leak	Enemy weapons fire	Will cause engine heatup and damage and will eventually destroy aircraft's ability to fly
Fuel Leak	Enemy weapons fire	Will gradually decrease fuel, shutting down engine when fuel reserves reach zero
Landing Gear	High-speed dive or weapons fire	May fail to deploy or retract
Flaps	High-speed dive or weapons fire	May fail to deploy or retract
Engine	Enemy weapons fire; operating at high temperature for too long	Engine can be hit multiple times, each time reducing the engine's performance
Droptank	Weapons fire from below	Explosion of fuel tank will damage airplane as well as cause the loss of external fuel supply
Pilot Wounded	Enemy weapons fire	Decreases controllability; the pilot will eventually die; chance of a successful bailout is lessened
Pilot Killed	Enemy weapons fire	Mission is over

you land or bail out to avoid capture by the enemy. Generally, if your pilot is wounded (the screen will throb red), an emergency landing is a better strategy than attempting to bail out because the wounded pilot will incur a much higher chance of suffering fatal injuries while bailing out than while attempting to land. In other instances, it is marginally better to bail out than to attempt a landing because the chance of suffering serious injuries when landing is slightly greater than bailing out. (The exception is attempting to bail out from an Me-262 when traveling over 300 mph—the result is always fatal.) Whatever the case, it is prudent to attempt to reach friendly airspace. For a German pilot, this is distinctively easier since geographically Europe is dominated by more German than Allied positions.

In many instances your plane will suffer sufficient damage to be considered a kill even if a critical hit has not been scored. Once you are sure that your plane has lost all hope of becoming flyable, bail out as soon as possible before your dive causes you to black out or the spin becomes too rapid to allow your escape.

Landing a damaged plane is an extremely risky enterprise. Whether you can return to base or must attempt a landing on a pasture or roadway below, remember to take stock of your plane's abilities. If flight control is just too difficult, do not attempt to land; bail out instead. It is far easier to incur serious injury or death from an emergency landing than from bailing out. Remember that it's your hide you are attempting to protect.

If you feel that you can control the plane enough to attempt an emergency landing, take your time and allow yourself plenty of room. Even when attempting to land at your own airbase, do not pay so much attention to remaining on the runway. Instead direct all of your efforts to keeping the plane's approach smooth, level, and slow.

If you have to bail out or perform an emergency landing over enemy lines, then you will be captured if you survive. If you manage to make it back into friendly territory, consider yourself lucky. Many a pilot sat out the war becoming an expert poker player in a German POW camp.

An Airman's Life

We few, we happy few, we band of brothers;
For he to-day that sheds his blood with me
Shall be my brother.

William Shakespeare, *Henry V*

A fighter pilot's experience in the Second World War was far more than a disconnected series of missions—it was an entire continuum, a day-by-day exercise in survival. Pilots were pilots 24 hours a day; they lived together, socialized together, and fought together. Life on the airbases was surrealistic at best without the foundations of normal life. There was no family, no weekends, and no escaping the terrifying fact that his next mission might be his buddy's last—or his own.

Life as a Fighter Pilot

Even though the combat missions were the focus of a fighter pilot's duties, life as a member of a fighter squadron held so much more. Preparation for the missions was ongoing, with pilots sharing tactics and observations over a warm beer in the Officers' Club. Bunkhouses were filled with the sounds of pilots gambling away their precious cigarettes and pinup photos. Chaplains listened quietly to the confessions of the pilots, their fears, their terrible dreams—their homesickness.

Three Different Worlds

For the three air forces in the service, although life was very different, each day brought the pilots similar challenges. For the pilots of the RAF, the war had been a reality for years. Often

Photo 9-1

Six pilots talk and share stories of the morning's mission.

they were stationed no more than an afternoon's train ride from home. As they visited their families during leave, they would travel through boroughs destroyed by Hitler's Luftwaffe. For them the war was personal, and they were fighting from their own turf.

Yet the British pilots had the rich tradition and heritage of their country to bind them together and give them confidence. Churchill was a warrior and the right man to command their war, and behind him rested the 1000 years of British monarchy, which added a seemingly timeless stability to their struggle. As they sipped their rationed afternoon tea in the bunkhouse, the fighters of the RAF talked of God and king and how their mighty Spitfires had shot the Germans from the sky, making them fall like dominoes.

For the pilots of the Luftwaffe, their day-to-day existence was filled with tension and foreboding. Try as they might to launch and shake off the war or relax with a game of chess, they felt the mounting desperation weighing heavily upon their shoulders. Germany was home, and now that home was being torn apart by the countless tons of bombs that rained down each day. With each mission, they acted as the shield for their homeland. Even though the odds made their missions difficult, the feeling that they could have done more always colored their hindsight. The

officers lived a life of tension, dreading the orders and dictums of their superiors. What would Goering expect next? How would Galland and Goering pull the Luftwaffe together again so they and their pilots could make a stand? Against the bleakness, however, there was a touch of hope that a new fighter would arise, that a new process could create the much needed fuel, that something would turn in their favor and allow them an advantage.

The war was thousands of miles from home for the pilots of the USAAF. Granted, Hitler was a maniac who had to be stopped, but deep down they knew that their home and families were safe. For them, their bases in England were not only in another world, they were in another time. On walks from the base, they would pass centuries' old farmhouses built of stone. The exotic aroma of burning peat filled their nostrils. For them, the English girls were exotic, coy, and friendly.

Days were spent together, and the laughter came easier for them than for the young men of the Luftwaffe. Even though the inherent terror of the possibility of death colored their hearts in a somber hue, they could see that the Allies were winning the war. They believed the madness would have to end soon. For them, the war was not in their own backyards; the bombed-out districts of London were not their homes. They were visitors—because of a moral obligation to stop Hitler and because patriotic Americans would not walk away from a good fight and would certainly not walk away losers.

In actuality, while the larger struggle of the Allies was based on a moral high ground, individual pilots often had a very hard time coming to grips with their roles as fighter pilots. Many Allied pilots walked away from their planes and were demoted, court-martialed, or hospitalized. Still others flew their planes into neutral countries such as Sweden or Switzerland to sit out the war in voluntary internment camps.

Life between Missions

Each day the pilots were kept busy well beyond their flight time. For the Allied fighter pilots, missions came every few days; the commanders needed their pilots rested and keen. Near the end of the war, the Luftwaffe pilots did not have it as easy. Constant scrambles forced the weary pilots into their planes day after day, and squadron leaders did their best to give pilots and planes a much needed day off.

One of the most important activities during a pilot's days was the simple act of conversation. Hours were spent over chow or at the Officers' Club going over missions. If a pilot pulled a maneuver that worked especially well, he told his fellow fliers. If a wing leader noticed that a rookie pilot was having trouble staying tight, he would give him a few pointers. More than the hours spent in flight school, the hours spent talking with other flight members became the key foundation of the pilot's development into a pilot to be reckoned with.

Often, experienced pilots and higher ranking officers were asked to deliver briefing programs to the new pilots. Not only did they explain the ropes of flying with the group, but also the quirks and rules of the airbase. In some squadrons, the rookie pilots were ostracized, seen as living with one foot already in the grave and not worthy of the time of day.

Poles throughout the airbase were mounted with scratchy-sounding speakers. Although they had been placed there to blurt out any warning of an impending attack, they were mostly used to play the daily radio war news.

The Luftwaffe pilots, before the situation became too dire, spent hours each week drilling and hearing the philosophy of the Reich, presented almost as a mantra to rationalize their country's actions.

For all pilots, however, the air too often was filled with the chimes of an ambulance rushing to the runway to recover an injured pilot. If possible, the wounded pilot would have radioed ahead and the fire trucks and ambulances would be ready. Occasionally, a wounded plane could not land. If the gear was stuck, a flight leader might order the pilot to belly-land his wounded bird. The pilots often watched—and prayed—as these damaged planes approached the runway for a belly-landing.

New Arrivees

For the new arrivees the focus was no longer on themselves and their training but on the war going on just outside of their cockpits. Experienced pilots and crew officers bolted to and fro, each with a look of purpose on his face. On the surface it was just a base—an airstrip, hangars, and a few buildings—not all that different from the training bases. Underneath, however, there was a determined tenor of purpose, a tangible something in the air that told the new pilot that death was not far away.

The new arrivees were assigned to flight wings (often in pairs) and then waited for a mission. On first arrival, time passed more slowly than later in their war experience. Not yet having proven their combat acumen, they were often placed on a back burner and forced to wait for a routine mission.

In the late afternoon they gathered to watch the fighters returning from escort, and each day they learned the names of more planes and the aces who flew them. As the specks appeared over the horizon, the speakers would signal their approach and everyone would count the planes coming in—hoping it would be the same as the number that took off.

Chow

Chow time was a social equalizer. Even though enlisted men and officers often ate in different huts or at staggered times, the myriad of flyers that descended on the chow lines brought with it a huge diversity of personalities.

Dining halls were filled with the din of conversation competing with clanking metal trays. This was not just a time to eat—food was merely a necessity. Eating became a time to talk and laugh.

On the morning of a mission, however, the dining hall could become quite a different place. Crews who were flying were often

Photo 9-2

Pilots line up for some hot chow and a cup of coffee.

roused in the early morning dark and had to eat breakfast under the harsh glow of incandescent light. This breakfast was a more somber affair. Pilots would feign good humor and an occasional laugh, but conversation often turned serious and the eating more mechanical. Once this meal was finished, it was just a short time until takeoff.

Social Life

Pilots took every available moment to relax and try to put the war out of their minds. Nights were filled with bunkhouse card games and checkerboard matches. Afternoons, on the other hand, were ideal for sports: cricket for the boys of the RAF; baseball, football, and volleyball for the Americans; and soccer for the Luftwaffe pilots.

Often, the Americans took to the countryside for walks around the airbase, strolling the dirt and gravel roads in an attempt to absorb the pastoral beauty of England. If possible, a bicycle was borrowed to create an adventure. Along with a picnic of warm beer, saltines, and chocolate it made for a great getaway afternoon.

Photo 9-3

A pilot and his squadron mascot (a mutt no doubt) relax atop a P-51 Mustang.

At night the American flyers headed to the Officers' Club to drink a cold beer and tell a tall tale. The clubs were always crowded until curfew. This was wartime, and the flyers were hesitant to break the bonds of socializing and disappointed to be making the long walk (or stagger) back to their cots. Occasionally dances would bring young ladies onto the base, and the dancing and endless games of flirting proved to be a tremendous relief from the pain of war.

It would be foolish to pretend that all pilots lived a life that was clean and morally forthright. Excessive drinking and fraternizing were common among the pilots. Venereal disease was a common malady treated at the base hospitals, and all soldiers were forced to view often graphic material urging the use of condoms and abstinence to avoid STDs. Pilots often played hard and dangerous games—dogfighting with bicycles for instance. Stunts and pranks were commonplace. The motor pool often was a few vehicles short of a full complement, a missing jeep filled with empty beer bottles showing up later in a ditch miles from the base.

For the Allied flyers, liberty was an expectation; for the Luftwaffe, it was a rare luxury. If possible, RAF pilots would return to see their families and visit with parents or a spouse and baby—and, of course, to eat a huge, home-cooked meal.

Photo 9-4

Pilots gather around the bar at an ad hoc Officers' Club.

For the Americans, liberty was an adventure, a chance to see the world of England. Major cities were the goal of most Americans, and a night on a firm hotel bed and the chance to meet a pretty woman were always welcome. In London, the enterprising pilots could catch a show or attend one of the big-band dances held for the soldiers—another chance to meet that pretty woman!

The dangers the pilots faced each and every mission turned their minds back home to their family and friends. Those who had never written so much as a holiday thank-you note became adroit letter writers. They learned to think of something new to say, some way to reassure their loved ones and themselves that they were doing just fine and would be home before long.

The letters would pass through Army censors (often a pilot's superior officer would censor his mail) before making the long trip home. Occasionally, a wife would find a letter cut up like Swiss cheese with words snipped out that might have revealed some iota of useful information had it fallen into the wrong hands.

Preparing to Fight

Pilots often knew if their flight group was up in the rotation, sitting on the bubble—next to fly a mission. They could only guess from the gossip in the Officers' Club and the radio reports of the war's progress as to what their next call would be. That call would come early in the morning, rousing them from their beds to gather for a quick breakfast and briefing.

Missions varied not only in objectives but also in scale. Some of the large-scale bombing attacks, the ones deemed a maximum effort by Air Force Command, would require nearly every available pilot and plane to muster for escort duty en masse. Others, such as the tactical ground strikes, would utilize smaller groups.

Whatever the nature of the mission, the pilots would learn the details in the briefing. Unlike the briefings given to the bomber crews, which were broken down into different need-to-know groups, the fighter pilots' briefings were held together because both flight leader and wingman flew their own planes and were expected to navigate properly if they suddenly found themselves alone in the sky.

After briefing, the pilots gathered their equipment, turned in their personal belongings, and headed out to the tarmac. Maintenance crews usually were just finishing work on their planes.

The pilots would be assigned a single plane, and it became their home away from home, often painted with their squadron's mascot or logo. The plane was a flying testament as to how well they had performed in combat. Successful missions were rewarded with the right to paint a German flag or other insignia on the fuselage to denote a kill.

Once the plane had passed a thorough ground check, the pilots would clamber up the wing and settle into the cockpit. The crew chief would provide last-minute words of encouragement and make sure that the canopy was properly secured. Soon the air above the tarmac was filled with the roar of massive engines and scented with the oily perfume of combat. Pulling the blocks from the wheels, the crew chief would signal the plane to taxi toward the runway and the mission ahead.

In the Air

Once in the air, the first order of business was to gather into flying formation, check the radio, scan the sky, and set a course for the first waypoint. In the larger scale missions, several wings often joined wings from other bases before proceeding to the rendezvous.

Now the pilots were serious professionals, well aware of the gravity of the missions and of their own danger—their working together was essential to their survival.

When the call for combat came, the pilots worked and thought as a unit, wingman and wing leaders sticking close. If a companion went down, pilots would strain to see the parachute of the friend open and then whisper a silent prayer before turning their attention back to their own struggles. Head-to-head combat was what the pilots had been trained for. In a protracted dogfight, they often saw their adversary many times as they flew hard to gain an advantage. The winner would be rewarded with a chance to turn his nose away and seek other targets. If he was lucky and he had reached the end of the mission, he could now turn toward the afternoon sun and begin the long ride back to base—suddenly it felt like home.

Missions generally lasted from 4 to 8 hours (much shorter for the reactionary Luftwaffe missions). Near the end of a lengthy mission, whether they had seen combat or not, the pilots would be both physically and mentally exhausted.

Interrogation

After landing, the pilots could not simply flop in their bunks and catch a few hours of sleep. The rest of the day was often spent in interrogation and debriefing. Moving right from the flight line to the debriefing area, they would drop their 'chutes and grab a cup of coffee and a sandwich while waiting for their call.

Brought in one at a time and again as a group, the pilots would recount their missions, particularly their encounters with the enemy. How many were there? Did you recognize all the planes? Did Baker take down one or two fighters? Did they employ any unusual tactics?

While the memories were still fresh in the pilots' minds, the Air Force had an opportunity to use their pilots as a front line of operational intelligence. Through them they could track the development of new enemy warplanes and tactics while attempting to make an accurate kill assessment.

After interrogation it was time to relax, take a quick shower, and head over to the Officers' Club for a well-deserved cold one.

Maintenance Crews

While the pilots were the brains controlling the fighter planes, the maintenance crews were the brawn. It was they who made sure that the planes could fly and perform at their peak.

Several enlisted men would work together as a maintenance crew for a single airplane, developing a special relationship with

Photo 9-5

Pilots review the day's mission through several hours of questioning and interrogation.

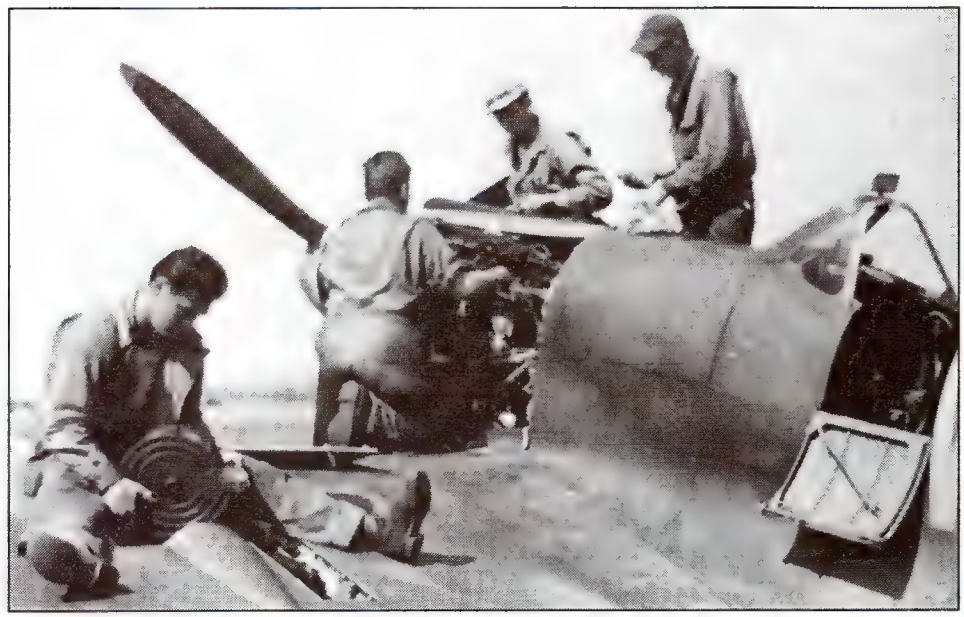


Photo 9-6

A flight crew goes to work under the cowl.

both plane and pilot. Each machine had its own quirks that the crew knew inside and out. The crewmen would lead entirely different lives than the pilots. They slept in different barracks, could not enjoy the Officers' Club, and often worked late through the night to prepare their pilots' planes for a place in the next morning's flight line.

It was up to the crew chief to keep the base commander apprised of the operation readiness of his plane, so that as the tactical planner he would have an accurate count of available planes for every mission.

The fighter planes were complex machines and required both repair of battle damage and constant maintenance to assure that everything was operating at maximum levels. Valve timing was adjusted often. The constant and vicious vibration of flight often rattled the engines out of sync. Gaskets were checked and replaced, superchargers tuned. Belts of ammunition were carefully laid into the wing. Control linkages were checked. For the crew chief, meeting with the pilot was a critical facet of his job because from the pilot he could determine what systems needed checking, what needed tweaking, and what needed reigning back.

Enlisting in a Career

Unquestionably the most rewarding experience you will have in *Aces Over Europe* is pursuing a career as a fighter pilot. By flying

as a participant in an historical campaign, you can pull together all of your flight skills and truly put your abilities to the test.

When you enlist in a career as a USAAF, RAF, or Luftwaffe pilot, you become a member of an historical squadron. There you have the opportunity to fly the myriad of mission types that were requested of the actual pilots. Occasionally, you become a participant in one of the historical missions featured within the simulation.

Your life as a fighter pilot allows you to advance in rankings, earn medals for meritorious actions, take on the best aces of the day, and get a true feel for the combat life of a fighter pilot.

Earning your wings as a career officer is no easy task. You fly as a member of a team, and whether your wing succeeds or not depends a great deal on how good you are at performing as a team player. Each career is unique, and the multitude of options provides you with months upon months of flying challenge and variety.

Throughout your career, you may fly in several offensive campaigns. You might find yourself brought before the board of inquiry or carried off in a stretcher. The career path in *Aces Over Europe* brings together all of the simulation's strengths and allows you to step back into the past as you attempt to fill the shoes of a fighter pilot.

To begin a career in *Aces Over Europe*, select Career menu from the main menu. In the Career menu, you will have an option to begin a new career or to continue a previously started career. You can also choose View Best Careers to bring up a list of the highest ranking careers you have previously flown. Selecting a pilot, then pressing the View button, will bring up that pilot's flight record.

Select Start a Career to begin your first career. You will then be asked which service to fly for. Each of the three services will provide you with unique flying experiences and will allow you the option to select very different campaigns. Click the Accept button after you have made your choice. Next, you will be asked to enter your pilot's name (up to 15 characters). Be creative and select a name that reflects the nationality of the service for which you are flying. Allow yourself to step into the pilot's shoes and become another person in another time.

The Start a Career screen will then give you a brief overview of your pilot and the service he is enlisting in. Click on the highlighted rank box to bring up a selection menu of the various ranks with which you can start a career. The top of the list is the lowest ranking flight officer, and the bottom is the highest. As a low-grade officer, you will be assigned as a wingman in your missions and must prove your worth (through productive flying) before earning a promotion. As the highest ranking officer, you will fly as the flight leader, making decisions as to the weapons loadout of the planes and flight formations. Also, through the radio you will have the greatest control over your wing during combat.

If this is your first career, select the lowest grade officer (also the default selection). You can gain valuable experience flying as a wingman and will not be immediately overburdened with too much responsibility. It's very rewarding to earn your wings the old fashioned way: by performing well. Select Start to move on.

You will next be asked to select a campaign. Later in this chapter you will find an overview of each of the campaigns in which you may participate. Selecting the Next and Previous buttons will allow you to view each of the campaigns available for the service that you have selected, beginning with April 1944 and moving through to the last months of the war. Clicking the Select button will bring you to the Squadron Selection screen.

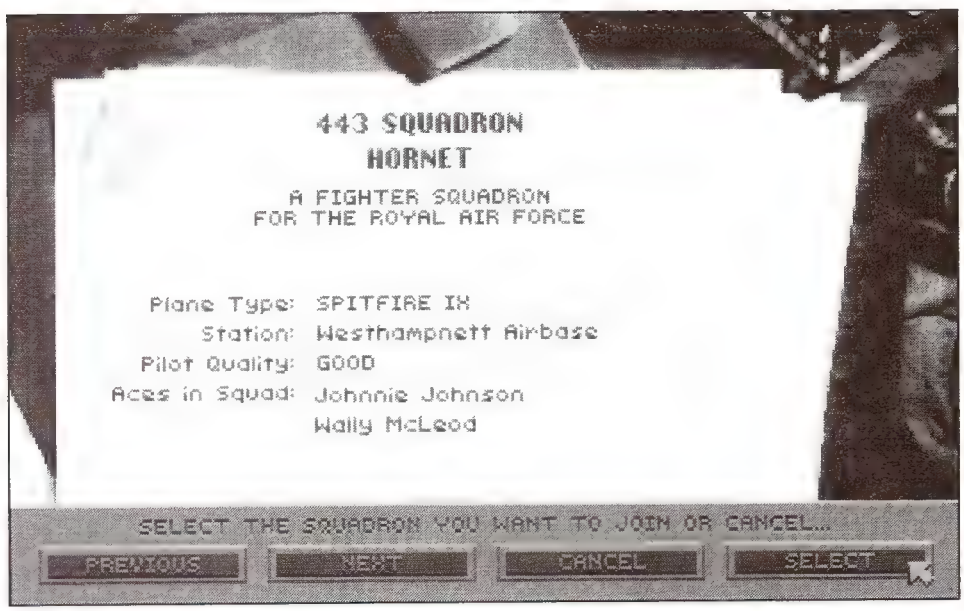


Figure 9-1

Squadron Selection screen

Using the same buttons as you did when selecting the campaign, you may flip through the squadrons that are available to you. A complete listing of all the squadrons available for each service appears later in this chapter. The squadron you select will be stationed at one of the many airbases throughout England and later, after the invasion, Western Europe. While the squadrons during the war remained relatively intact, they were often forced to change their airbases because of their changing role in the war or the movement of the front line. Throughout your career, you will be informed if you are relocated. Pressing Select will bring up a map that will show you the location of your current airbase.

Airbase Menu

After you have worked through the menus to set up your career, you are presented with the Airbase menu. This menu is your base of operations throughout your career. Here you will be able to embark on your combat missions gather information about your situation, and perform pilot backups. You can return to the main menu anytime by selecting that option from the Airbase menu. Also, tapping the [B] key will temporarily obscure the menu so that you can view the photo beneath it; tapping any other key will return the menu.

Selecting Squadron Info brings up an information sheet on the service letterhead giving you the basic facts concerning your

Figure 9-2

Airbase menu

squadron. You will also find a list of any aces who are currently assigned to your squadron (yourself included if you have earned that level of notoriety). Flying with an ace in your Finger Four will most certainly increase your chances for success.

You may also select View the War Map to review your airfield's location. Scroll the War Map to look it over and gather information on the various bases and cities depicted on the map. The War Map will change throughout your career to indicate the changing front.

View Aircraft will bring up the same general display as in the View Vehicles option, except that you are limited to examining only the plane that you are currently assigned to fly. The plane will be colored corresponding to your current squadron's markings.

Your Pilot Record

View Pilot Record gives you the statistics on your pilot. From this screen, you can track the progress of your career. Missions Flown indicates how many individual missions you have taken part in, while Successful Missions indicates only those missions in which you achieved at least a moderate degree of success. Escorting a bomber flight that gets shot out of the sky does not constitute a successful mission.

Perhaps the most important and exciting statistic is the Air Victories category. Remember that five victories earn the title of

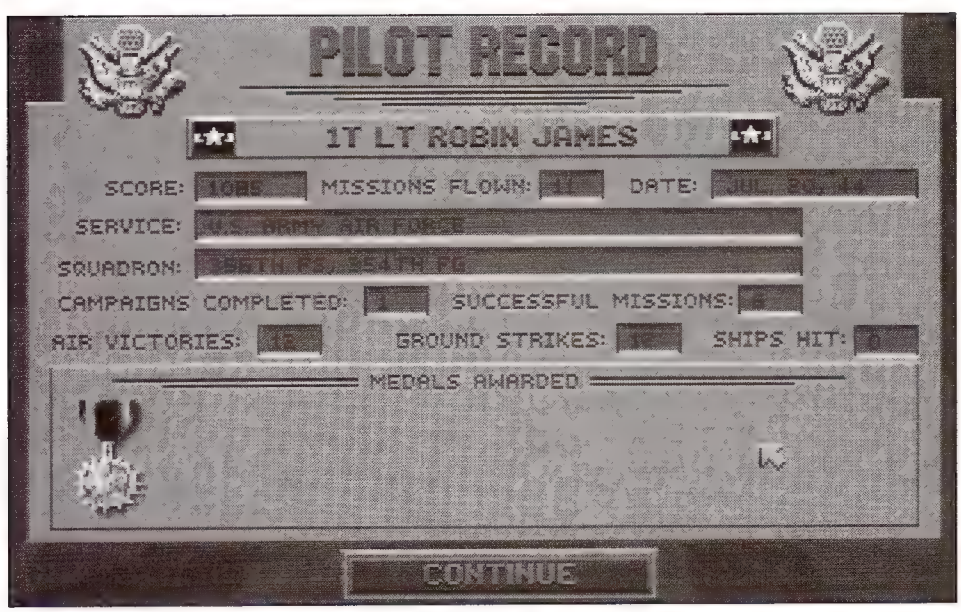


Figure 9-3

Pilot Record screen

ace. You can check your kills count against those of the war's most famous aces by returning to the main menu and selecting the Dogfight a Famous Ace mission. If you complete the war racking up more kills than any historic ace in the service for which you are flying, you will be named the Ace of Aces.

The bottom third of the display is devoted to presenting your hard-earned medals for exceptional performance. Later in this chapter you'll find an overview of the medals you can strive to wear on the lapel of your dress uniform.

Backing Up Your Career

Even though *Aces Over Europe* saves your current career when you leave the Airbase menu, you will want to back up your career often. Selecting Backup Career presents you with a prompt to enter a 15-character description of your career. If the pilot roster is full (you can only save 11 pilots at any one time), you will be prompted to delete a pilot before you may complete the backup.

At the end of any mission (successful or not) you will have the option of replaying the mission without damaging your career. If, however, you must exit the simulation or you have completed a mission in which you feel that you should have done better, you can select your backup from the Career menu.

Taking to the Air

The Fly Next Mission option from the Airbase menu provides a mission briefing for your next mission. Generally, you are given from several days' to a week's rest between missions, but occasionally the unpredictability of the war will force you into the air sooner than you would like.

The mission briefing screens are similar to the single mission screens. You may choose Decline Mission to pass on a particular mission. By selecting Fly Next Mission again from the Airbase menu you will be able to examine another mission set for the same day. This can be done many times since the simulation will create a new mission each time the Fly Next Mission option is selected, taking into account the date, your squadron, and its purpose. At times you will find yourself flying the historical missions that have been included in *Aces Over Europe* if your squadron was involved and the timing is right. Flying these missions is a very exciting and challenging facet of your fighter pilot career.

You will most certainly want to check out the Preflight Options screen before taking to the air. In the Form window you will see your place in the formation, which will be highlighted. Unless you have been promoted to a high enough rank to act as flight leader, you cannot change any of the mission settings. You will want to pay close attention to your additional weapons loadout and whether or not you will be flying with a droptank. Should you encounter enemies before you reach your mission goal, you will need to drop your ordnance to regain your plane's maneuverability.

Once you have reviewed your mission briefing screens, select Begin Mission to begin your flight. You will start out on the runway, lined up in whatever place you are in the formation. When the plane ahead of you begins to move, you may apply full throttle and start your takeoff. Once in the air, follow the planes ahead of you to bank to the proper heading. You may select autopilot ([A]) to fly to the next destination of your mission.

Flying as a Wingman

When flying as a junior grade flight officer, you will be expected to serve as the wingman for either your section leader or the flight leader. This is a job that you must take seriously, and how well you support your leader will directly affect the outcome of the mission.

Keep your eyes open and practice stable flying at either the left or right of your leader (depending on what side of the formation you are assigned). After returning to normal flight from autopilot, your flight will automatically be flying in proper formation. Use this as your reference point.

Perhaps the two most important tasks for you as a wingman will be to watch the outside rear sector of your formation for bandits and to watch the bottom of your screen for radio messages. Do not break and attack until told to do so. Do not break from your leader unless given the order Attack the Fighters! Even then, try to keep close so that if your leader calls for your assistance, you will be able to come to his aid and brush the bandit off his tail.

If you are flying as a section or flight leader, as mentioned in Chapter 8 the radio is one of your most important tools. It requires considerable practice to activate and send radio messages

when in combat, but it is a skill well worth acquiring. Practice by selecting the radio(S) when in a dogfight, even when flying as a wingman. Scan the menu, then hit Esc to exit. Becoming a quick read will improve your chances for success.

Remember that in career missions, it is important to think with a team mentality. When you become a solid flyer, you will find yourself racking up the lion's share of a mission's kills. Remember, however, that it was the other members of your flight who helped you get those good numbers by mixing it up with the enemy or by damaging the ground target you later destroyed.

At Mission's End

When you have completed your mission, you must return to your airbase. (For a few missions, the mission will end with no need to return the base; simply tap Esc to end.) You may either fly in manually or select autopilot to return to base. When you are over the base, you may choose to land the aircraft. If your plane is damaged, it is most certainly in your best interest to attempt an actual landing; however, if the plane is undamaged, simply tapping Esc and selecting the End Mission Anyway button will generally result in a safe return to base.

You will then be presented with a Mission Summary, which lists the success or failure of your mission as well as the targets hit by both you and the other members of your flight.

Getting Word from HQ

At times during your career, you will receive communiqués from headquarters and hear the gossip on the tarmac. You will be informed of any squadron relocation; or, if your squadron is disbanded, you will be assigned to a new home. You will also receive teletype messages from headquarters informing you of major tactical decisions and of major events throughout the war. While strategic decisions will play a role in the type of missions you will most likely be flying, the news of major events will probably be slanted to boost pilot morale.

You may also catch wind of rumors or receive the congratulations of your crew chief upon completing a mission. Listen to what he has to say, but temper that with the knowledge that the information is largely based on hearsay and may or may not reflect the truth.

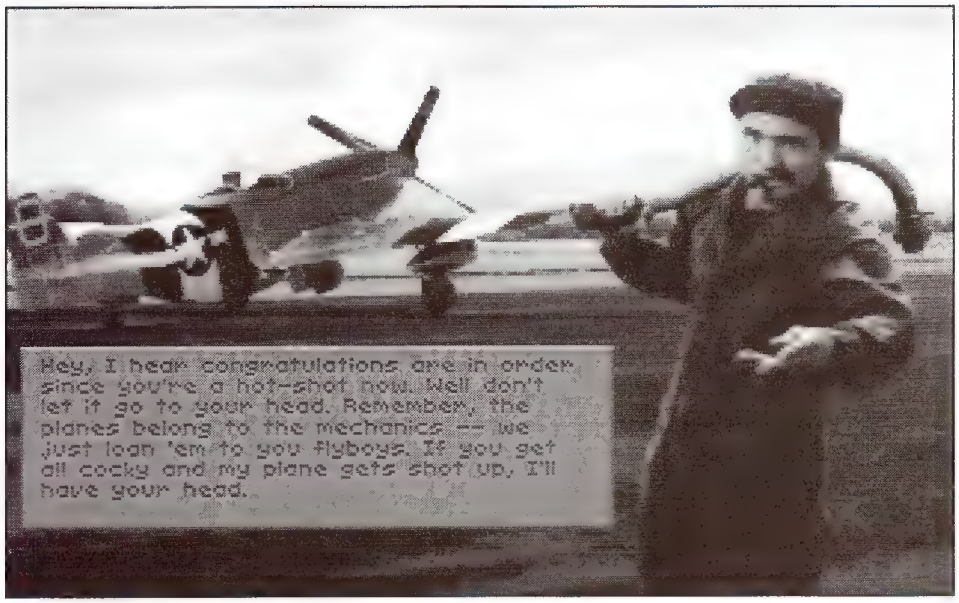

Hey, I hear congratulations are in order since you're a hot-shot now. Well don't let it go to your head. Remember, the planes belong to the mechanics -- we just loan 'em to you flyboys. If you get all cocky and my plane gets shot up, I'll have your head.

Figure 9-4

A USAAF crew chief gives the pilot an earful.

In the heat of battle, it is often difficult to tell the enemy from your ally, especially when the sun casts darkening shadows and you are flying on pure adrenaline. You might find yourself accidentally laying a burst of fire into your wingman. If you happen to shoot down a friendly aircraft, you will be brought before the Board of Inquiry when you return to base. You will find them lenient on the first offense, but appear before the board for a third time and you will be stripped of your wings and grounded immediately.

Working through the Ranks

The only way to work up through the ranks in *Aces Over Europe* is to fly—and fly well. Rewards tend to come to those who most deserve them. If you have proven yourself in combat, you can count on a promotion. Flying well in *Aces Over Europe* means ending a majority of your missions as successes. If you fly many missions but never quite achieve the missions' objectives, your promotion will arrive more slowly.

When you receive a promotion, give yourself a pat on the back—the honor does not come easily. You will receive word from headquarters and watch a newsreel clip of the promotion ceremony. With a promotion you receive greater responsibility. Perhaps you will become a flight leader for a two-man mission and finally, when you have reached the highest rank, you will be

the flight leader. Then your fellow pilots will look to you not only for leadership in battle but also for mission fine-tuning.

Decorations and Medals

As you continue to fly, your skills and bravery in combat hopefully will call for recognition. Each service presents medals to those pilots who distinguish themselves well above the expectations placed upon them. If you are chosen for such an honor, you will receive word from HQ, view a newsreel of the presentation ceremony, and have the medal permanently displayed upon your pilot record.

Medals of the USAAF are:

- **Purple Heart** Instituted by George Washington during the Revolutionary War, this medal is given to those who are wounded in combat against an enemy of the United States and who require medical attention. Whenever possible, this medal is given to the recipient before or immediately after entering the hospital.
- **Air Medal** Instituted to award "meritorious achievement while participating in an aerial flight," this medal is generally awarded for performing in missions that do not include tangling with an armed opponent and was often given to fighter pilots after flying ten missions.
- **Silver Star** Initiated in WWII, the Silver Star is presented to recognize gallantry in action when the action in question does not warrant a Distinguished Flying Cross.
- **Legion of Merit** This medal is presented to those who have shown consistent heroism beyond standard expectations in the face of the enemy but who have not yet performed an isolated action of extreme heroism mandating a higher honor.
- **Distinguished Flying Cross** The second highest honor given, the Distinguished Flying Cross is presented in the name of the president, to those aviators who have shown exceptional heroism against an armed enemy of the United States.
- **Congressional Medal of Honor** The highest medal given by the U.S. military, the Congressional Medal of Honor was signed into existence by President Abraham Lincoln in 1861. It is presented to those who have performed an individual act of heroism that required bravery "above and beyond the

call of duty." The award is given only when an individual performs an act of heroism in the face of the enemy while risking his or her own life.

Medals of the RAF are:

- **Distinguished Service Order** Given to those pilots who performed "meritoriously and beyond expectation," the Distinguished Service Order was initiated in the nineteenth century for extreme service to His Majesty's Armed Forces.
- **Distinguished Flying Cross** This medal is presented to a pilot for exhibiting extreme bravery or for performing an extraordinary act under the face of enemy fire.
- **Croix de Guerre** Given by the French military in honor of extreme heroism in the liberation of France, the Croix de Guerre first awarded in WWII, is the French military's highest honor.
- **Victoria Cross** The highest award given for military gallantry in service of God and King, the Victoria Cross was initiated in 1856. The bronze used to form the star of this medal came from a Russian cannon that was captured by the British during the Crimean War.

Medals of the Luftwaffe are:

- **Iron Cross** The Iron Cross, 2nd Class, was given to German military personnel for individual acts of bravery or exceptional service; well over two million were issued during WWII. The Iron Cross, 1st Class, was the only award given by the Nazis that they did not initiate and was presented to a Luftwaffe fighter pilot after achieving the rank of ace with five enemy kills.
- **German Cross in Gold** Initiated by Hitler in 1941, the Cross in Gold was presented to honor a continuous record of service and outstanding achievement. The recipient of the Cross in Gold must first have been awarded an Iron Cross, 1st Class.
- **Knight's Cross** There were also varying grades of this medal. The Knight's Cross of the Iron Cross was initiated by Hitler in 1939 to honor not only military but also civilian service. For Luftwaffe pilots, a Knight's Cross was awarded for a set number of enemy kills. Like inflation, the number

rose throughout the war from 20 kills to well over 100. The Knight's Cross with Oak Leaves and Swords was an upgraded Knight's Cross and was first presented to Adolf Galland on July 15, 1941, for achieving 69 enemy kills. The Knight's Cross with Oak Leaves, Swords, and Diamonds, referred to simply as The Diamonds, was first presented to Werner Molders for downing 28 Russian planes in just over 2 weeks. Only 26 of the medals were ever presented.

Career Campaigns

The many campaigns that you may select as you begin a career allow you to become a participant in the various strategic struggles of the air war over Europe. When you select a campaign, you fly a number of missions until your tour of duty is completed. After completing a campaign, you receive an overview of the campaign's success or failure. You then have the option of continuing to fly missions within that campaign or selecting another campaign to enter. After selecting your next campaign, you may opt to switch squadrons as well. In this way, *Aces Over Europe* allows you considerably more flexibility than the actual pilots enjoyed.

USAAF Campaigns

Beginning on April Fool's Day 1944 the six American campaigns focused on interdiction, close-support, and escort missions. The 8th Air Force, armed with conclusive evidence that Hitler's Wehrmacht was suffering due to the collapse of the wartime industries, stepped up its attacks on German industry. Also, the ground troops, beginning with the push into France and ending with the drive across the Rhine in Germany, needed all the help they could get in taking out tactical targets behind the rapidly moving front.

In the table below and the tables which follow for the RAF and the Luftwaffe you will find an overview of the squadrons that are available for your Career missions. The home airfields are not listed because the squadrons moved about constantly. The overall quality of the pilots remains the same throughout the war as do the presence of aces, unless you are flying in a squadron with an ace who has been shot down.

Table 9-1 USAAF Fighter Squadrons

ID[a]	Moniker	Type	Plane	Pilot Rating	Campaigns[b]
356 FS, 354 FG	The Red Asses	Fighter	P-51D	Excellent	1, 2, 3, 4, 5, 6
Aces: G. Eagleston, J. Howard, D. Turner					
338 FS, 55 FG		Fighter	P-38J	Average	1, 2, 3, 4, 5, 6
343 FS, 55 FG		Fighter	P-38J	Average	1, 2, 3, 4, 5, 6
487 FS, 352 FG		Fighter	P-51D	Excellent	1, 2, 3, 4, 5, 6
Aces: G. Preddy, J. Meyer					
328 FS, 352 FG		Fighter	P-51D	Excellent	1, 2, 3, 4, 5, 6
334 FS, 4 FG		Fighter	P-51D	Excellent	1, 2, 3, 4, 5, 6
336 FS, 4 FG		Fighter	P-51D	Excellent	1, 2, 3, 4, 5, 6
Aces: D. Gentile, J. Godfrey					
62 FS, 56 FG		Fighter	P-47D	Excellent	1, 2, 3, 4, 5, 6
Aces: D. Schilling, H. Zemke					
61 FS, 56 FG		Fighter	P-47D	Excellent	1, 2, 3, 4, 5, 6
Aces: F. Gabreski, R. Johnson					
401 FS, 370 FG		Fighter	P-38J	Fair	1, 2, 3, 4, 5, 6
374 FS, 361 FG		Fighter	P-51D	Good	1, 2, 3, 4, 5, 6

[a]FS = Fighter Squadron, FG = Fighter Group

[b]1 = Struggle over France, 2 = Bocage Nightmare, 3 = St. Lo Surprise, 4 = Drive on the Frontier, 5 = Ardennes Christmas 6 = Drive into Germany (No aces in this campaign)

Struggle over France—April 1, 1944

Beginning in the spring of 1944, both the 8th and 9th Air Forces were charged with breaking down any potential German resistance to the early summer invasion. The French rail system and the German military trains running the rails were the primary targets of the Transportation Plan, whose goal was to bring German troops and military mobilization to a grinding halt.

Bocage Nightmare—June 6, 1944

After the landing of the Allied forces on Normandy Beach, the need for close support of the advancing ground forces was greater than at any other time during the war. While the invasion went

off better than anyone could have hoped, the Germans proved to be tenacious opponents whose troops still held the majority of French territory. It was a battle across pastures and through villages, and interdiction missions were key in disrupting the German attempts at reinforcement and retaliation. Toward the east, the 8th Air Force stepped up its attacks against German industry, emphasizing oil, gas, and synthetic fuel facilities.

St. Lo Surprise—July 20, 1944

The advance through France left the German army weak and retreating, and the Luftwaffe threat became almost nonexistent. On individual missions the opposition still remained determined, but the German pilots flew with the desperation of caged animals. Still, the strategic bombing campaign dropped tons of bombs over German targets while close support and antishipping missions sought to push the front back toward the Rhineland. Finally the hedgerow-by-hedgerow battle lead to the Allied liberation of the French town of St. Lo.

Drive on the Frontier—September 1, 1944

With Germany's resistance nearly toppled and the distraction of the Russian advances to the east, the time was right to make the move toward the German border. The Luftwaffe had to be destroyed, and attacks targeted German airfields, straffing the planes on the runway. The 8th kept the bombing pressure intense and targeted industries as soon as they were rebuilt. They relied on intelligence to locate facilities that had escaped Allied bombs and targeted them. Interdiction missions gained more weight as an impending push east relied on the success of the 8th.

Ardennes Christmas—December 15, 1944

The German forces managed a counterattack on Allied ground forces in the Ardennes forest. Ground and air forces alike were forced to contend with the cold, harsh winter, and close-support missions were the priority in an attempt to beat back the insurgent Reich. In the air the Luftwaffe utilized its Me-262 jet fighter—a fearsome sight for escort fighters—as well as the Arado Blitz bomber that could strike quickly. Intercept missions were forced to race against the clock and the odds.

Drive into Germany

As winter broke, the Allied forces knew that victory was near. The time was ripe to launch the drive across the Rhine and into the heart of Germany. Although struggling for lack of fuel, planes, and competent pilots, the Luftwaffe still managed pockets of tough resistance. The new school of Me-262 aces was making its name known on Allied airbases. Interdiction and cleanup bombing missions would prepare the way for the ground assault.

RAF Campaigns

The RAF paid its dues early in the war, facing Hitler's Luftwaffe over France and Britain. It was all too happy to receive the help of the USAAF. When the 8th Air Force of the USAAF began the strategic bombing campaigns over Germany, the RAF handled the majority of the nighttime bombing raids. Later, the RAF worked with the 9th Air Force to perform extensive ground-strike and sweep missions. The RAF also had the fast and powerful Mosquito to perform as a tank buster and as a light bomber, providing for interdiction missions with more punch than the Americans could deliver.

Air Offensive in Normandy—April 1, 1944

Working in tandem with the USAAF, the RAF flew countless sorties against targets on the coast of northern France as well as interdiction strikes beyond the coast. Utilizing their powerful Spitfire, the RAF pilots were charged with sweeping the Luftwaffe from the skies over the beaches of Normandy in preparation for the joined British–American invasion.

The Normandy Beachhead—June 6, 1944

As the Allied forces stormed inland from the transport barges, the RAF was charged with mixing it up for the Luftwaffe, keeping the fighters away from the troops as they attempted to secure the beachhead. In addition, Spitfires patrolled the rear areas in a search for German ground movement. They struck at anything heading toward the beaches and blasted open corridors to allow the Allied forces to increase their foothold in France.

Table 9-2 RAF Fighter Squadrons

ID	Moniker	Type	Plane	Pilot Rating	Campaigns[a]
132	City of Bombay	Fighter	Spitfire IX	Average	1, 2, 3, 4
164	Argentine–British	Fighter	Typhoon	Good	1, 2, 3, 4
181		Fighter	Typhoon	Average	1, 2, 3, 4
248		Lt. Bomber	Mosq. XVIII	Good	1, 2, 3, 4
274		Fighter	Tempest	Excellent	3, 4
305	Wielpolska	Lt. Bomber	Mosq. VI	Good	1, 2, 3, 4
333	Norwegian	Lt. Bomber	Mosq. VI	Excellent	1, 2, 3, 4
349	Belgian	Fighter	Spitfire XIV	Good	1, 2, 3, 4
Ace: R. Harries					
41	Fighter	Spitfire XIV	Good	1, 2, 3, 4	
443	Hornet	Fighter	Spitfire IX	Good	1, 2, 3, 4
Aces: J. Johnson, W. McLeod (campaigns 1-3)					
486		Fighter	Typhoon	Fair	1, 2, 3, 4
602	City of Glasgow	Fighter	Spitfire IX	Good	1, 2, 3
610	County of Chester	Fighter	Spitfire XIV	Fair	1, 2, 3, 4
Ace: A. Malan					
613	City of Manchester	Lt. Bomber	Mosq. VI	Good	1, 2, 3, 4

[a]1 = Air Offensive in Normandy, 2 = The Normandy Beachead, 3 = The Hard Road, 4 = Victory Assured

The Hard Road–July 19, 1944

General Montgomery planned a break from the beachhead and pushed east toward the German border. To support the advance, RAF units devoted their energies to providing ground support for the troops, paying special attention to the German armor reserves. Countless interdiction missions were flown to break the German channels of supply and reinforcement.

Victory Assured–December 1, 1944

As the weather began to clear, British forces prepared to strike forward toward the Rhine River, hoping to cross and push on toward Berlin. RAF units worked the front line extensively, disrupting German reinforcements and battling any Luftwaffe resistance they encountered.

Table 9-3 Luftwaffe Fighter Squadrons

ID	Moniker	Type	Plane	Pilot Rating	Campaigns[a]
II/JG-1		Fighter	FW-190A	Good	1, 2, 3, 4, 5
Ace: H. Baer					
III/JG-2	Richtofen	Fighter	FW-190A	Good	1, 2, 3, 4, 5
I/JG-4		Fighter	Bf-109G	Average	4, 5
III/JG-7		Fighter	Me-262	Good	4, 5
Ace: T. Weissenberger					
II/JG-11		Fighter	Bf-109G	Fair	1, 2, 3, 4, 5
Ace: Guther Rall (campaign 1)					
II/JG-26		Fighter	FW-190A	Excellent	1, 2, 3, 4, 5
Aces: Josef Priller, Adolf Glunz					
III/JG-26		Fighter	Bf-109G	Excellent	1, 2, 3, 4, 5
I/JG-27		Fighter	Bf-109G	Poor	1, 2, 3, 4, 5
II/JG-54	Green Hearts	Fighter	FW-190A	Excellent	2, 3, 4, 5
III/SG-4		Fighter	FW-190F	Excellent	1, 2, 3, 4, 5
JV-44	Squadron of Experts	Fighter	Me-262	Excellent	5
Aces: J. Steinhoff, A. Galland					
III/Kg-76		Lt. Bomber	Arado 234B	Good	5
	Kommando Nowotny	Fighter	Me-262	Good	4
Ace: W. Nowonty					
II/KG-51		Fighter	Me-262	Fair	2, 3, 4, 5

[a]1 = Defense of France, 2 = Against the Beachead, 3 = Girding the Storm, 4 = Defense of the Frontiers, 5 = The Last Hurrah!

Luftwaffe Campaigns

For the Luftwaffe, the early summer of 1944 was a dark time. Its ranks were in chaos, and airdromes were being bombed out as fast as they could be repaired. Pilots were tired, and morale was low. The campaigns of the Luftwaffe remained largely reactionary throughout the last 14 months of the war with an emphasis placed—much to the pilots' dismay—upon intercepting Allied bombers.

Defense of France—April 1, 1944

With the invasion of France expected any day, the Luftwaffe was charged with intercepting the constant strikes of the Allied

fighters and bombers. Because the invasion could happen almost anywhere (and perhaps in more than one location) troops amassed along the Atlantic Wall. Luftwaffe units flew cover for these troops. They struggled not only to ward off the enemy planes but also to protect their airfields, which were under almost constant attack near the coast. As a result, many units relocated several hundred miles south.

Against the Beachhead—June 6, 1944

The invasion upon it, the Luftwaffe struggled to react effectively and sent fighters out to attempt to strafe the beaches and guard against any Allied attempts at breakout. With a majority of the trained fighter force on the Eastern Front, the Luftwaffe pilots who remained were unskilled in ground attacks; nevertheless, they fought with determination.

As the Allied forces began to inch their way inland, the German ground troops fought bravely to hold their ground, and Luftwaffe pilots were asked to provide the best support they could.

Girding for the Storm—July 15, 1944

More a reaction than a planned offensive, the German campaign was a scramble to beat back the Allied forces who were building up momentum. The Allies had broken free of the beachhead and were advancing quickly. All the while, strategic bombing attacks laid waste to German industry. The Luftwaffe, in a seemingly endless stream of missions, was charged with intercepting the Allied planes and bringing their pilots down before any more damage could be done to the Reich.

Defense of the Frontiers—September 15, 1944

Strained in every possible way, the Luftwaffe struggled to keep planes in the air to oppose the Allied air offensives. The Allied campaign against Germany's oil industry had left them scrounging for fuel. Still, when possible, new planes were being built. In the words of one Luftwaffe official, "It is better to have planes with no gas than to not have any when we most need them." Luftwaffe interception missions operated with bare-bones personnel in an attempt to ration what capabilities they did have until the resources could be built up once again.

The Last Hurrah!—December 1, 1944

Months of stockpiling fuel and a batch of new pilots gave the Luftwaffe the resources to once again initiate large-scale operations. Working in close-support and aerial-sweep roles, the Luftwaffe jumped to the offensive in support of Germany's Ardennes advance. The Luftwaffe pilots also targeted the multitude of new Allied airbases in recently liberated Holland and Belgium, hoping to cut back on Allied air superiority by forcing the Allies to regroup and relocate the frontline bases.

Things to Consider

The most important factor to consider when flying a Career mission is survival. Just as returning to base alive was of the highest priority for the actual fighters, it should be yours as well. Living to face the enemy again will make you a more valuable contributor to your service than going down in a blaze of bullets. If you find your plane damaged, turn away from the fight and head for friendly airspace or back to your airfield if possible.

If you are unsure how to proceed with an attack (particularly a ground attack against a heavily defended position), let the other planes in your flight take the lead. They have the experience to know the best route of attack, and at times observation can be the best teacher.

When you are acting as the flight leader, remember that your wing is relying on you for guidance. Do not forget to order them to attack or break the engagement, and do not hesitate to remind your wingman to watch your tail.

The career missions that you fly cover a wide range of challenges. At times, you may find yourself flying escort and no enemies will show themselves. Other times, you may find yourself in what seems to be an impossible situation, set upon by four FWs—two of which are piloted by high-ranking aces. Just remember to keep cool, keep working with your flight, and keep alive.

The ability to replay a mission immediately without penalty is a great help in getting your mission right. Use the opportunity to try out different tactics in an attempt to gain the advantage. The way the missions are initiated in *Aces Over Europe* gives you subtley different situations even in a replayed mission. If you are expecting bandits to appear at one o'clock low, don't be surprised to find them on your tail when you replay the mission. You need

to keep thinking. Above all, don't be afraid to experiment because creativity is the parent of greatness.

Since the majority of missions is generated within the simulation, the replayability of a career path is excellent. Even flying an identical group through the same campaign results in an entirely new array of missions and makes the career games always a fresh and challenging experience.

From the Journal of Lloyd "Buster" Stinson

Captain, USAAF, 356th Fighter Squadron, 354th Fighter Group; September 13, 1944

...a few days of rest will do my body good. Last week, I flew my first mission against one of Hitler's ground fortifications, and the warnings I've heard around St. Croix certainly proved to be true. Three weeks ago I earned my captain's bars, and I've lead five missions already. Thinking like a flight leader has taken some getting used to, and I can't seem to approach the ground crews with the authority I know I'm supposed to have. At times, I still feel like a rookie, like these last six months have all been some kind of long, terrifying training exercise.

We were sent out to take down the Siegfried Line fortification at Ettlington, and I loaded us up with rockets. I'm still new at the whole deal with rockets and haven't had much luck aiming, but Watkins assured me that they're the way to go.

We approached without incident, and I ordered my boys in for the attack and let Skyler take the lead. The landscape just didn't mesh with our mission briefing, but I trusted his judgment on the approach. At 800 feet and about a half mile out the AA fire started in. At such low altitudes, the sound is just unbelievable! The wings rattled for every shot even remotely close. I must have been terrified because it felt like I didn't even blink for the entire run. I just kept both hands on the stick and my eyes glued to Skyler.

I didn't pick a target—just kept right on following the Skyman, watching as he let four rockets fly right into the dark slit of a mouth in that first pillbox. He must have hit some serious ammo because that baby just blew sky-high!

The trouble was I was in too deep and hadn't picked a target. I edged my rudder to line up for the far pillbox and watched the tracers scream out of the darkness and right toward me. I should have just broke and made another run, but I was juiced. Like an idiot, I flew over the whole length of the compound. My belly was a ripe target for those Jerry gunners who just kept shooting and shooting. I let two salvos go before I knew what was happening. I just remember thinking, is this it? Will I crash and be captured? Or will I burn up in the wreckage? Like some damn accountant I counted six solid hits on my bird before I shook out of my trance. Then I nosed down and let that baby have my last four rockets. I swear I could feel the heat as it blew right under me.

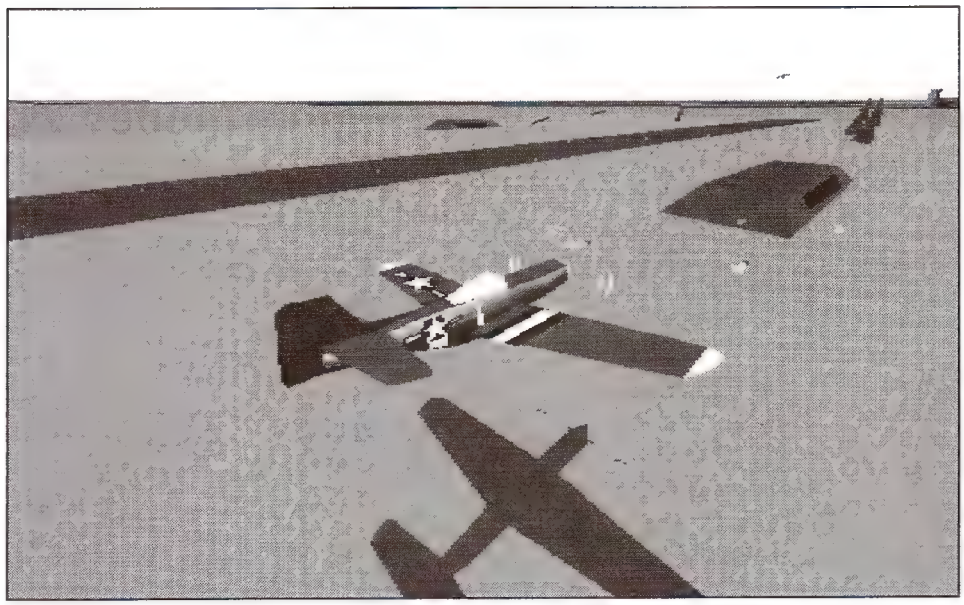


Figure 9-5

Taking out a pillbox at close range with a salvo of rockets

By the time I came around and got my head back on straight, my boys had finished cleaning up. It was time to head home, and I felt like I did on that first mission, like I didn't know a damn thing...

...Yesterday, they announced that a Major General Elster surrendered to our boys at a place called Beaugency. Twenty thousand Jerries just laid down their rifles and called the whole thing quits. Brother, what a sight that must have been...

Retirement

No matter how well or how poorly you fly, you will not be able to change the outcome of the war and the eventual capitulation of the German forces. At war's end, you will retire (with distinction, we hope) and see your final ace status ranked with all of the other pilots. Remember, if you end the war with the most kills, you will earn the honor of being named the Ace of Aces.

In the war, the RAF and USAAF pilots would end their tour of duty after a certain number of missions. After achieving a significant level of service, they could be withdrawn from combat duties. Often the aces were sent stateside to drum up support for the war efforts by telling stories of their gallantry and the heroism of "our boys."

For the Luftwaffe, the future did not hold such promise. They fought until killed, captured, or wounded. Often they racked up hundreds upon hundreds of missions, fighting back exhaustion and the gnawing specter of apathy.

It was a hard road to live day-in and day-out as a fighter pilot, but thousands of men, flying for both the Allied and German forces, fought on with bravery, intelligence, and honor.

The Never-Ending Assault

Destroy the Enemy Air Force wherever you find them, in the air, on the ground and in the factories.

General "Hap" Arnold, USAAF

D-Day and the weeks immediately following had given the Allied forces a strong foothold on the European mainland. From that position, they prepared to descend deeper into France and eventually make the turn east toward Germany. On the Eastern Front, Germany was fighting the Russian army—once a tenacious yet malleable foe who now seemed to grow in strength by the day. Already the Russian air force, even though hampered by planes that were inferior to those of their adversaries, possessed a significant numerical advantage and effectively took the Luftwaffe out of the battle.

The 8th and 15th Air Forces had set into motion their bombing campaign targeted at taking out all major centers of fuel production and storage, and the 16 months of successful Allied strategic bombing had left nearly every major German city heavily damaged. For the Allies, victory's light shone at the end of the long tunnel. It would be a hard road—no one doubted that—but every battle report and strategic summation pointed to one inescapable fact: the German resistance was decaying as the Allied forces grew stronger. The Allies possessed an increasing advantage and there was no turning back.

Although at times the German military came to grips with its dire situation, it still fostered hope that it could pull together, call upon all its resources, and push back the Allied advances to

Photo 10-1

The ruins of Nuremberg, spring 1945

recapture all of Western Europe. Masked behind the delusional panacea of the Third Reich's propaganda, some commanders still saw the potential for victory within their grasp. Creating forced fiction—reports less grim than the reality of the situation—for presentation to the Fuehrer colored their own judgment as well.

Luftwaffe after D-Day

The Luftwaffe was a frazzled mess by the time the Allied forces secured an inland position in northwestern France. Through sheer force of will and miserly logistical allocations, German fighter production had remained high; but there simply were not the pilots available to fly the planes. The strategic campaign against Germany's fuel reserves and production facilities had reduced the available fuel to dangerously low levels, and all of the Wehrmacht's forces suffered. Adolf Galland realized that if the bombing continued unchecked and Germany allowed the last of its synthetic fuel facilities to be destroyed, it would lose the war.

As mentioned in Chapter 3, the Luftwaffe reeled under the continuous loss of its veteran pilots and was forced to accelerate the training of young cadets to an almost foolhardy pace. The fuel shortages meant that young pilots could not train in the air and entered frontline service as unskilled pilots. As feared, the results were disastrous. In the mess halls of the German airdromes, veteran pilots kept their distance from the new arrivals,

Photo 10-2

Allied bombs fall on a ball bearing plant.

casting only furtive glances over their shoulders at the young, innocent faces. The veterans knew these young men were already dead, that the remainder of their lives would be counted in days and not years.

Still, Goering and Hitler held to the unrealistic and deluded notion that given enough high-speed bombers, the Luftwaffe could initiate a blitz campaign of terror bombing and grind the British to their knees by destroying the urban centers of England. The Me-262 was already in production as a fighter, but Hitler's misinterpretation of the plane's abilities led to his declaration that they should all be refitted as bombers. Hitler, guided by emotion and poor information, had latched onto the idea that the Me-262 could be the blitz bomber he had been looking for.

To make matters worse, the Allied forces were now relying more heavily on their Ultra decoding system, which enabled them to intercept transmissions about most German counterattacks, leaving Hitler's forces stymied and searching for a way to hold their ground.

Battle for France

Near the end of July 1944, the 8th Air Force executed a series of low-altitude (12,000 feet) heavy bombing missions over fortified German army positions to the south of the Allied forces. To keep road destruction to a minimum, fragmentation bombs were mixed with general-purpose bombs, and the bombers rolled out. Flying in tighter-than-usual formations, the bombers found that proper targeting became difficult because the first of the dropped bombs spewed giant clouds of dust into the air. The bombing raids did not do significant harm to the German ground forces, most of whom hid in fortifications or underground communications tunnels. The effect on German morale, however, was dire. For the ground forces, watching the hordes of Allied planes rumble toward them with no Luftwaffe planes in sight produced feelings of utter abandonment. Interrogated POWs confirmed the Allied air force's speculation that the bombing was debilitating the German communication systems and succeeding in breaking apart the cohesion between ground units.

In early August, the Allied forces began their breakout from northern France. Instead of ordering a retreat, Hitler urged the XVII Panzer Corps to attack and cut off the thinning American force. Americans intercepted the attack orders and were well prepared to meet the offensive, and close-support missions rained

Photo 10-3

USAAF B-17 bombers line an airstrip in southern England.

down bombs from above as the German armies moved further into a pocket between Allied forces.

Instead of closing in on the Germans, however, the Allied forces had their eyes set on the distant objective of Paris and left the backdoor wide open. Even though tactical air support decimated the German war machines, many of the most experienced of the German troops managed to escape.

In the air above France, the remaining Luftwaffe fighters battled doggedly against the incessant Allied tactical strikes. Even though they brought down many American planes, the cost was unbearably high. In the month of August, the Luftwaffe lost nearly 900 Bf-109s and FW-190s, 44 percent of their total fighter force.

The Y radio-interception service, provided by the 3rd Radio Squadron Mobile of the 9th Air Force, was second to none. Crewed by skilled linguists who understood the colloquial and idiomatic banter of the German pilots and their ground controllers, Y was able to recommend attacks on German airdromes when the vast majority of the planes were on the ground. Allied fighters were able to sweep and begin their attacks before the bewildered Luftwaffe pilots could scramble to intercept them.

FLY SINGLE MISSION: SCRAMBLE: LUFTWAFFE

In a Scramble mission, your airbase is already under attack and you must get into the air as quickly as possible to beat back the aggressors. While Allied airfields would deal with scrambles on an occasional basis, a vast majority of scrambles occurred over Luftwaffe airdromes.

The Scramble missions occur throughout the war, but you may select the FW-190D9 or the Me-262 as your plane for missions in the later months of the war.

When you select Begin Mission, you find yourself on the runway preparing for takeoff as the Allied fighters fill the sky above. Generally you are outnumbered, and you can rest assured that at least one of the Allied pilots has spotted you and will attempt to take out your plane even before your wheels leave the ground. To give yourself a fighting chance, steer your plane away from the runway's center as you taxi and lift off as soon as possible, retracting your gear the minute the plane becomes airborne.

Because this mission is do-or-die, you should consider selecting Full Guns to give maximum punch to your shots. Break left or right soon after you leave the ground and attempt to intercept

an Allied plane. The dogfighting is close to the ground, so always keep and eye on the altimeter and give yourself at least 500 feet of altitude before you try a long, tight turn with any deflection shooting. Remember that the primary goal of the mission is twofold: to stop the enemy from destroying the buildings at your airfield and to shoot down all of the enemy fighters.

The FW-190D9, when armed with Full Guns, packs a massive offensive punch and reaches good maneuvering speed very rapidly, which gives you a decided performance advantage over most attackers. When flying the Me-262, you have to perform evasive maneuvers on the runway because it takes a full 15 seconds to become airborne. Once in the air, the Me-262 is a sluggish plane to fly at low altitudes and at low speeds. Attempt to get in very close behind an enemy plane and deliver a blast with your cannons. Depending on the number of enemies attacking, you may want to fire with a single set of guns since the ammunition stores on the jet are not nearly as full as on the FW-190D9.

Failure of Market-Garden

In the late summer of 1944, the Allied forces were pressing west, euphoric with the sense that victory was nearly within grasp. Generals Patton and Montgomery, bitter rivals and each a brilliant tactician, commanded their ground forces—Montgomery to the north working with General Omar Bradley and Patton further south. Each pressed for a directive to provide him with

Figure 10-1

Attempting to make it into the air under a hail of Allied gunfire

the full resources of the Allied forces for a piercing run across the Rhine and into Germany. Eisenhower, now heavily involved in the ground war, turned down both pleas in favor of a moving front that would gradually push the Germans back.

As the situation evolved, it appeared that Montgomery's British forces would have the best chance of success. They possessed a clear line through Antwerp and then on toward the front line. Montgomery had won the coin toss, and Patton's forces were hamstrung in order to provide the necessary resources for Montgomery. On September 14, the Allied air forces began a campaign aimed at taking out the vital rail arteries that crossed the Rhine. Their goal was to prevent the German forces from reinforcing the Siegfried Line. In the excitement that preceded the operation, Montgomery hoped to crush the German resistance and end the war before Christmas day.

Operation Garden was to propel the British Second Army along a pencil-thin front, then have the forces cross the Meuse-Escaut Canal and move on toward the Rhine. Further operations were to include reinforcing the Allied position between Arnhem and the Zuider Zee in preparation for rolling over onto the northern German plains. To make Garden a possibility, Operation Market was created to send out paratroops in advance of the ground troops. These paratroopers would be charged with capturing and establishing bridgeheads.

The combined effort, operation Market–Garden, was initiated on September 17, 1944, with a full half of the Allied airborne forces sent out in advance of the ground attack. They parachuted out from over 1300 aircraft and nearly 1200 gliders. While the newly landed troops scurried to secure a foothold, the Allied air cover forces were prohibited from initiating attacks upon ground fortifications until first fired upon. This tactic gave the Germans a decided advantage, and they shot over 60 Allied planes out of the sky that day.

As the paratroopers fought hard for small pockets of territory and a few precious bridgeheads, the German resistance was far stronger than had been anticipated. Still, they fought bravely and held on, waiting to link up with Montgomery's spearhead offensive.

The British Second Army met with far fiercer resistance than estimated, and the narrow road that made up the front was dotted with well-camouflaged German positions. As they struggled

forward, the American paratroopers had managed to secure a meager hold on some 20 to 25 miles of territory. However, communication lines set up between their positions and Montgomery's forces were continually broken by German forces, leaving them essentially alone. The paratroopers held out against daunting odds, and the continuous struggle left them exhausted. Even when able to rest, they had to keep guard. The German forces seemed to know where they were and where they were heading at all times. Montgomery's forces attempted to send reinforcements up the line, but they were unable to reach the relief positions.

In the air the weather had turned sour, and Allied aerial support was temporarily halted. Finally, on the 25th of September, the failed offensive had ground to a halt. Efforts were made through the foggy nighttime hours to withdraw as many at-risk troops as possible. By September 29, 1944, the operation was considered a failure.

While Montgomery was chastised for the foolish and poorly researched offensive, he himself considered it a 90 percent success, having captured bridgeheads over four major waterways. In the cost of lives, morale, and supplies, the exercise was an objective bust—certainly considering that the ultimate goal had been a quick and decisive end to the war. Sadly, many battles lay ahead.

Deployment of the Me-262 Jet Fighter

Aside from Hitler's call to retool many of the existing Me-262s into light bombers, day commander Adolf Galland still held out hope that this combat-proven plane could be utilized exclusively as an effective bomber-busting intercept fighter.

In the late summer of 1944, the speedy RAF Mosquitoes ran into the Me-262 for the first time, and the "wooden wonder" was unable to escape the speed and deadly cannon fire of the newest Messerschmitt. The kills against Mosquitoes proved the Me-262's worth as a fighter, and in one of Goering's last bold moves, he called on SS chief Heinrich Himmler for assistance in obtaining permission to set up an experimental Me-262 jet fighter wing. In October, Goering had his permission to set up the wing to be sent into action against Allied bomber attacks. Hitler had softened slightly because of the availability of the Arado 234B

jet bomber, and he agreed to release one Me-262 for each Arado delivered.

Galland was surprised with this rare opportunity and turned to top-scoring Luftwaffe ace Walter Nowotny to lead the group, which would be based in two airdromes on the Allied bomber path over the Reich. This new wing would be known as Kommando Nowotny. The 32-plane-strong wing was soon mixing it up with the Allied bombers and accounted for 22 Allied kills in October alone, forcing the Allied escort pilots to adopt a tighter formation in flight.

For a time Allied commanders feared that these fearsome, cannon-wielding jets might turn the air superiority tide back to the Luftwaffe, but it turned out that those fears were unfounded. As powerful a weapon as the 262 was, it came too late in the war to stop the massive Allied bombing onslaught. Also, the plane was not without its weaknesses and the Allied fighters soon discovered that the jet was vulnerable during its slow takeoffs and landings and immediately targeted the two airdromes for attack.

On October 19, 1943, Major Walter Nowotny received the Knight's Cross with Diamonds for reaching the unheard-of level of 250 kills as a Luftwaffe pilot. Between July 1941 and receiving his Knight's Cross, he flew more then 442 missions. Twice in his career he racked up ten kills in a single day.

Although he earned the respect and admiration of all the Luftwaffe for his stellar combat performance, he began his career

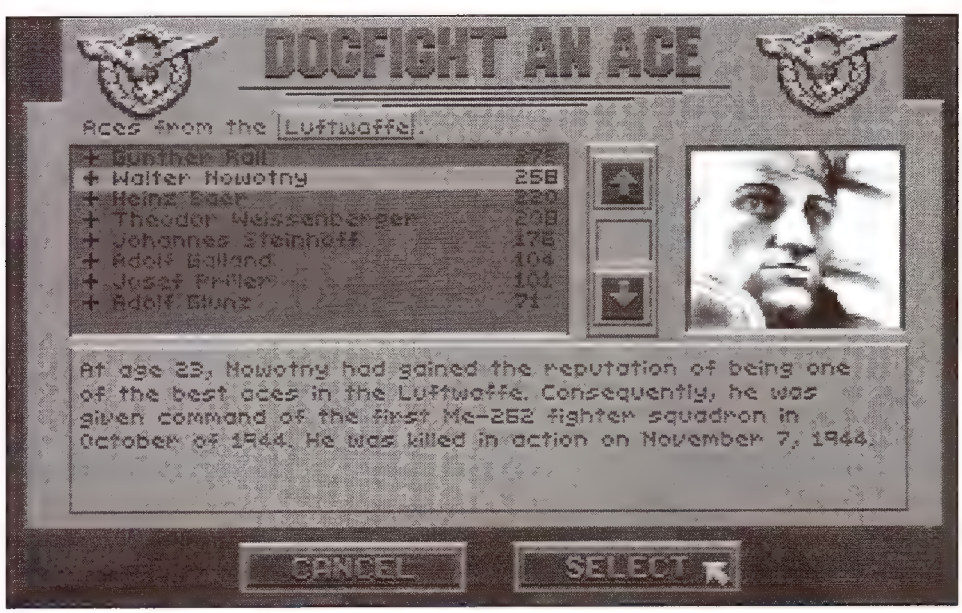

DOGFIGHT AN ACE
Aces from the Luftwaffe:
+ Walter Nowotny 258
+ Johannes Steinhoff 176
+ Adolf Galland 104
+ Adolf Glunz 71
At age 23, Nowotny had gained the reputation of being one of the best aces in the Luftwaffe. Consequently, he was given command of the first Me-262 fighter squadron in October of 1944. He was killed in action on November 7, 1944.
CANCEL
SELECT

Figure 10-2

Major Walter Nowotny as seen in the Ace Selection screen

slowly. He attended the fighter pilot school near Vienna when he was only 19 years old. After 5 months of combat flying, he scored his first kill. At the end of that mission, he was shot down over the Baltic Sea and spent 3 days paddling a life raft back to shore. By June 1943, he had reached his stride and scored 41 kills in that month. By mid-August he had reached 150 kills.

When Kommando Nowotny became a reality in October, Nowotny had already reached 255 kills and scored three more in the fast Me-262 before being caught by an incoming Allied raid in November 1944. He crashed before Adolf Galland's eyes as he attempted to land his plane. Nowotny's last radio transmission reported "Just made third kill... left engine fails... been attacked again... been hit...." Galland left the operations room, knowing that Nowotny would attempt to fly his wounded bird back to base. The cannon fire of the jets could be heard above the din of the flak batteries, and while Galland scoured the skies Nowotny's plane came into view as it dove down to avoid Allied P-51s. Nowotny attempted to guide his plane to the airstrip, but the damage was too great and his speed too fast—his plane slammed into the earth and exploded into a plume of flames.

FLY SINGLE MISSION: FLY A HISTORIC MISSION: LUFTWAFFE: DEFENSE OF THE FRONTIERS: OPENING DAY AT ACHMER

On October 7, 1944, the newly formed Kommando Nowotny faced its first trial by fire. American bombers had been sighted to the north, and five Me-262s were called to intercept. A flight of P-51s descended as the planes attempted to take off. Two of the Germans were shot down as they took off and a third as it waited on the airstrip for a clear flight path. Only two of the turbojets made it into the air.

Immediately upon beginning this mission, you find yourself under attack from a pair of P-51D Mustangs. For the first few seconds as your turbojet engines build up the necessary thrust, you are completely helpless. As soon as you start to move, swerve down the runway as you pick up speed. Once in the air, raise your landing gear. You may be able to get a good shot or two at a P-51 as you take off. Select Full Guns if you have the opportunity.

Once in the air, you have two different ways to approach the mission. You may attempt to take out the P-51s that are attacking the airfield, but will probably find that the Allied pilots can fly rings around your Me-262. If you choose to attack, don't

forget to order your wingman to attack as well (if he made it into the air, that is). You cannot win in a dogfight, but if you build up sufficient speed you can employ hit-and-run attacks against the P-51s—pull away and make a wide 180-degree turn before turning to make another attack.

You may also choose to allow the flak towers to do their job and attempt to proceed to the enemy bombers. Check your Flight Map ([M]) and look over your flight plan. Return to the cockpit and turn to the proper heading, just slightly east of due north, and leave the Allied fighters behind. Again, remember your wingman and order him to get on your wing. Once you are far enough from the base, select autopilot ([A]) to proceed to the bomber formation.

In an Me-262, the frontal approach is fast to allow you to aim well. The best approaches are either a high-angle stern attack (the most risk of gunfire but the easiest to get a hit) or a high side attack (least chance of getting hit but more difficult to aim). Order your wingman to attack, choose a target, and head in for the kill.

If you manage to wound a bomber but don't shoot it down, look for the plane as you make your wide turn for another pass. Chances are, it has become a straggler and you can pick it off rather easily.

You discover that even with a wingman, it is virtually impossible to take out a majority of the bombers. Rest assured, though, that your attacks have rattled the bomber pilots and may very

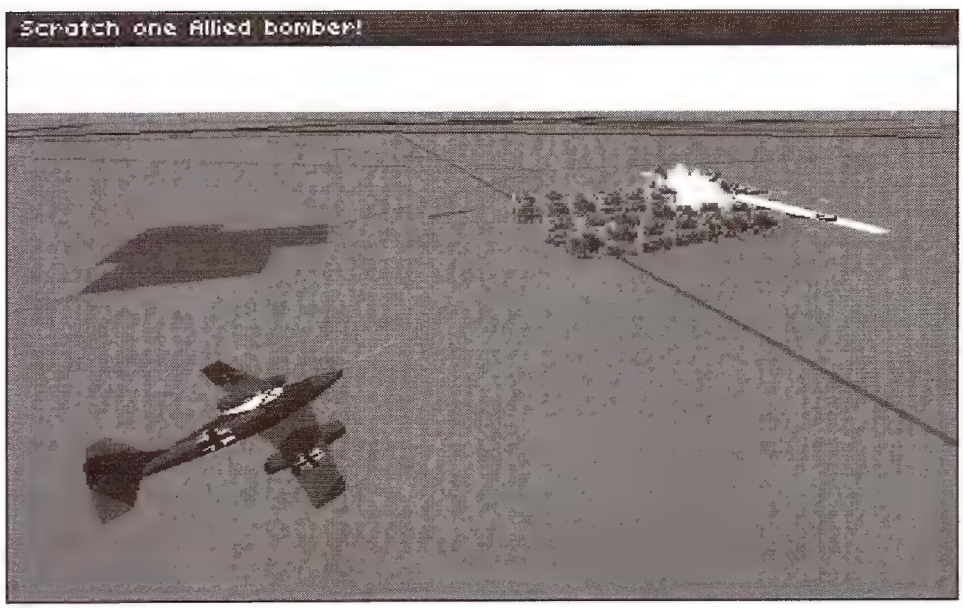


Figure 10-3

An Me-262 going in for a kill on a wounded B-17

well have caused them to miss their attack run, even though you took down only one or two planes.

Do not risk yourself in unnecessary attacks (on the other hand, go ahead; after all, it is only a simulation). Instead, when you are wounded or nearly out of ammo, head south back toward Achmer. Once you move far enough away from the bombers, the mission ends.

Resurgence of the Luftwaffe

Allied air efforts in the fall of 1944 seemed to range the sky with the freedom of a Sunday drive. The Luftwaffe appeared beaten, now only a patchwork of worn-down planes and inexperienced pilots. The once-feared jet fighters had displayed a critical weakness, and the Allied air forces had numerical advantages in every field. Back home, USAAF pilot training relaxed after operating at a near-fever pitch. It seemed obvious that there were already more than enough pilots in the loop. (It would be several more months before Navy pilot training eased up as the end grew near in the Pacific theater.)

Then in November, the pilots noticed a change. Suddenly, more Luftwaffe fighters were rising against the bomber screen and more Allied planes were being shot down. The Luftwaffe had been redeploying its assets, moving nearly 90 percent of its forces to the Western Front against Europe, having effectively given up air superiority on the Eastern Front. Bombing missions fell to a mere trickle, mostly carried out in daring nighttime raids with the jet-powered Arado bomber. Former bomber pilots were sent out in the cockpits of fighters. Although they were relatively green in combat tactics, they had already accumulated significant flying time.

The Allied campaign against the fuel supplies of the Reich had nearly wiped out all stores and production capabilities, but the Germans had hoarded and been forced to employ extreme measures of conservation. On the airfield, this meant utilizing domesticated animals and flight crews to move the planes around the field in order to conserve fuel. Pilots coming in for landing were instructed to cut their engines as soon as possible. Some even did so in the air and glided their planes onto the airstrip. Fuel additives were tried, engines adjusted.

In the makeshift factories, the Germans had stood up to the test and managed to increase their fighter output. Creative

designers reworked portions of the planes to take advantage of more available materials. The tail of the Bf-109 was constructed out of wood instead of aluminum and steel. Where once the production of single-engine fighters was handled by 27 plants—now nearly all destroyed by Allied bombing operations—the operations were split up and modularized. Planes were being manufactured at nearly 730 smaller shops around Germany in villages, caves, forests, and old mines.

On November 2, 1944, the Germans put 400 fighters into the air to intercept two separate bomber streams. The 8th Air Force set out to bomb the synthetic oil facilities at Mersburg-Luena and encountered strong opposition, but the German fighters were held off by the P-51 escorts. Another bomber stream did not fare as well and before the Mustangs could rendezvous with the bombers, 60 Luftwaffe fighters descended and picked apart the formation. In the minutes that followed, every circumstance favored the Americans, who counted themselves lucky to have only 26 bombers shot from the sky.

The Allied leaders were worried. While the numbers of Allied bombers had increased, the number of fighters had not. It appeared that Germany might have an advantage. The Germans threw newer versions of old planes armed with more powerful weaponry into the fray and began experimenting with new and more deadly formations. For the moment, at least, the Allied air forces abandoned their larger strategic objectives and once again met head-on with the pilots of the Luftwaffe.

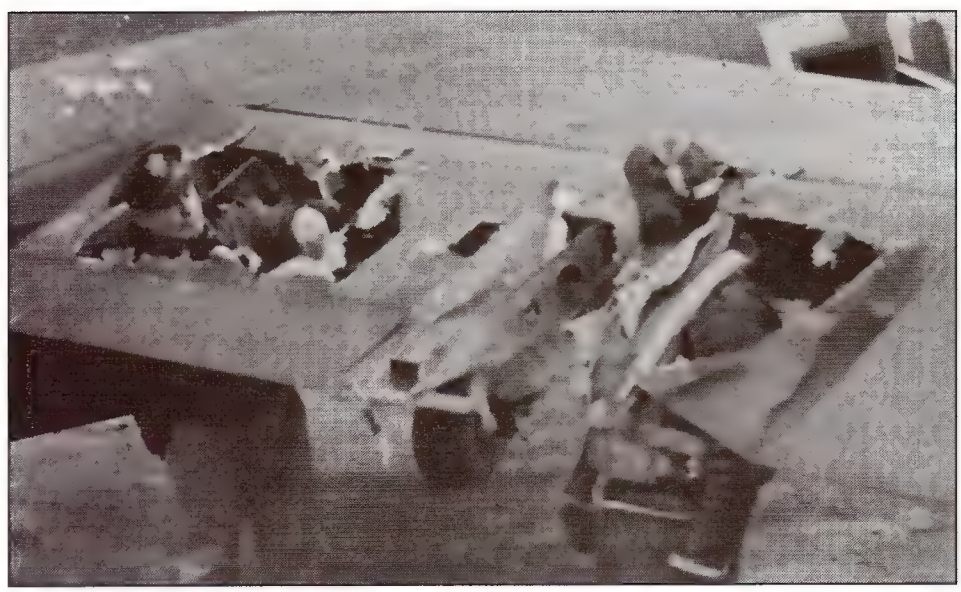


Photo 10-4

The flak-damaged tail of an Allied bomber

Emphasis shifted from industrial targets to German airfields, where the shortage of fuel caused many of the planes to still sit idle. Although many planes were destroyed on the ground, it seemed to be only a minor distraction for the Luftwaffe, who found it relatively easy to repair the damage or move to another airdrome. For the moment, however, the Luftwaffe possessed more fighters than it had fuel or pilots for.

Adolf Galland began to deploy his fighters in rare but effective mass interceptions, mustering over 500 fighters for a single mission. The cost in precious fuel was enormous, but their efforts daunted the Allied forces who did not want to tangle unnecessarily with the fierce, newly determined Luftwaffe.

Battle of the Bulge—Christmas 1944

Galland had seen the success of his large-scale strikes (even when accompanied by unacceptable losses, slight victories burned unrealistically brightly for the dying Reich) and began the process of stockpiling fighters for a massive, one-day assault on the American bomber fleet. On November 12, Galland notified Goering that the assault, known as Big Blow, was ready to proceed. Thousands of planes awaiting the command to fly needed only a modicum of clear weather—and, of course, an Allied bomber assault—in order to attack. Unfortunately, the weather remained overcast for weeks. Then in late November, Hitler ordered the redeployment of 1200 fighters to the Western Front to support Germany's counteroffensive through the Ardennes forest. Big Blow was permanently put on hold.

Something Brewing in the Woods

From mid to late November, the 9th Air Force's reconnaissance planes battled exceptionally poor weather and regularly reported back that their main mission objectives had been a wash. The planes did report, however, that steady German vehicle traffic was moving between the Rhine and the Mosells and that heavy rail activity had been spotted.

Late November promised a break in the weather, and reconnaissance planes were able to see what they thought might be camouflaged trucks or supply piles a few miles to the north of Duren. Another flight noticed suspicious-looking haystacks in areas where there were no other signs of agriculture. Could they be hiding tanks or trucks?

The first weeks of December were wet with freezing rain and sloppy snow, and very few recon flights managed to get airborne to investigate these sightings further. Then one mission in early December did take advantage of a break in the miserable weather, and the pilots noticed a train loaded with nearly 200 flatcars bearing German tanks.

More and more reports came in on a daily basis, clearly indicating a serious buildup of German forces. That crucial information, however, became lost in the "noise of the system." For some reason, there were no clear channels of communication in place between the 9th's reconnaissance units and the Allied ground forces. This failure to disseminate information was so great that although the buildup had been repeatedly related, in a report given to Eisenhower a mere 18 hours before the German offensive commenced, the Ardennes region was dismissed with the matter-of-fact "nothing to report."

Germans Attack

In the early morning of December 16, 1944, the Germans began their offensive utilizing the 6th SS Panzer Army—which consisted of five infantry and four panzer divisions—to strike at the heart of the Allied frontline troops. The attack began with small skirmishes to give the impression of a reconnaissance-in-force mission, but when the true thrust occurred, the frontline Allied troops found themselves utterly surprised, outnumbered, and outmaneuvered. Through the chaos that followed, Allied troops beat a hasty retreat through the snowy forest floor in an attempt to evade the German forces that were beginning to surround and choke their position.

On that first day, the Luftwaffe flew few aerial attacks, partly because of the poor weather and partly because they did not yet want to completely reveal the strength of their hand. On the second day, however, the Luftwaffe rose in force to offer close support for the Ardennes advance. Fortunately for the Allies, the Luftwaffe pilots, seized by the excitement of the offensive, were often too quick to dump their ordnance and break away for dogfights with Allied planes, thus limiting their support role for the ground troops. Once the attack was underway, the Allied air forces rose to meet the Luftwaffe and flew countless sorties over the front lines to keep the Luftwaffe from penetrating and aiding

in the offensive. The Allies reacted in time, and air superiority remained theirs despite the aggressiveness of the Luftwaffe pilots.

On the ground, the fighting was desperate. The Allied forces were nearly surrounded and battling for their lives. In what seemed to the ground troops like an eternity, Allied air reaction picked up steam and by December 26, the effects of Allied bombing raids virtually eliminated the possibility for easy ground travel. Roads were destroyed and Allied fighters swept the area continuously, forcing German vehicles to attempt to move under cover.

The Allied ground resistance and the superb air cover took its toll on the offensive. Movement became impossible because of terrain that had become a veritable forest of rubble and because the precious German fuel had begun to run out. The Germans had blown massive fuel reserves on the offensive, confidant in their ability to capture Allied fuel. That just hadn't happened, and the offensive lumbered to a halt. The Germans had failed.

From the Journal of Lloyd "Buster" Stinson

Captain, USAAF, 356th Fighter Squadron, 354th Fighter Group; Saturday, December 23, 1944

...the boys had been toughing it out down there for nearly a week, and finally we had clear enough skies to give them a hand. We were sent to sweep the skies near St. Vith—behind the line. The propaganda box kept telling us that our boys were holding tight, that they were advancing, but word around the Officers' Club was that they were running scared out there in the snow and trees so close to Germany.

It was a strange few days. Inside, we all felt that the war was over, that we had won, but it just seemed as if the Krauts didn't get it. Why didn't they just throw up the flag and be done with it? They would make us keep fighting and keep dying until it was just all over and out.

Willy went out on two sweeps yesterday and said that the Jerries were fighting like animals—like crazy dogs; that's what he said. As we headed out for our sweep through the clouds and under the stars of early morning, those words kept playing over and over in my head: like crazy dogs.

We flew low, following the roads through the breaks in the clouds. All seemed still below but if you squinted hard enough, you could see that something had been happening down there.

As I was craning my head to see, the radio crackled "Krauts at twelve o'clock, four of 'em." I nosed down and saw that they were flying away from us still holding to their Schwarm, so I ordered the attack.

In the shallow dive, my Mustang crawled up past 400 mph. We still had the surprise. I picked my target but changed my mind at the last minute and banked right to fire on the rearmost Messerschmitt. Simons fired first at my target, and the Kraut banked right into my gunfire. There was a flash of flame and less than a second later a "pop." The plane winged over and fell like a leaf.

I rolled level and punched it, flying under the number three plane. Then I cut the throttle, nosed up, and lay a ripe burst right into his landing gear. Nothing for a moment, then a few telltale sparks. He banked off, a little streamer of oil-smoke etching his path through the early morning sky. I twisted back in my cockpit to watch the chute fluff open.

Banking around to pick up the chase, I saw my other section going for the last two bandits. I guessed that they felt outgunned because they were screaming away at full throttle. I had to nose down into a shallow dive to pick up enough speed to close, and as I edged past Saunders, the Jerries seemed to be pulling away. I hadn't remembered that the Messies could sprint like that. I was ready to turn about and re-form when I saw the silhouettes grow a touch larger—all of a sudden, they had banked around and were coming at us with full guns blazing.

I winced as bullets ripped across my wing, but I nosed up to try to get a shot off. I wasn't sure if I hit anything, and then he flew right toward me. My P-51 seemed stuck in wet cement as I tried to pull hard left to avoid the collision. I could see the little droplets of oil streak from the exhaust vents and across the cowl. For a moment, time froze into a snapshot as we stared at one another. He looked crammed into that cockpit, stuffed like a sardine. His mask was off his face, and I could see lines that told me he was too old to be a flyer. His jaw seemed set in this maniacal clench and he flashed me this look with his eyes—a look of pure, absolute hatred and exhaustion and fear all rolled together. I'll never forget that instant, I'm sure of it, not as long as I live.

Figure 10-4

A Bf-109 attempts to get away from a P-51D.

I jerked back to reality and arced around to get in behind him. I was rumbling with a ton of different feelings: I hated him, I was sorry for him, I felt superior to him. I tried to shake myself clear as I came into range. I held my fire for only an instant—this was war, after all. A two-second burst of fire, magnesium flashes as the shells peppered his fuselage, and then the plane fell from the sky.

I broke away and ordered my flight to form up, not giving any explanations as the last German streaked away. I just wanted to fly and fight and feel no pity, but at that moment, I just couldn't be sure what I felt...

Operation Bodenplatte

Blasted by Hitler for their inability to perform and called cowards by their leader Goering, the pilots of the Luftwaffe burned with an inner fury. They knew that they had given all that they could and that they were ready to give more. Credit must be given to the lesser commanders—those who flew the missions and knew the hardships and told the straight truth—and to Adolf Galland, a vibrant and enthusiastic leader (who had unfortunately fallen into disfavor with Hitler and was stripped of his command). Credit must be given since on the darkest day of the winter of 1944, when Gruppen had to scrounge for fuel and faced harrowing odds daily, the pilots' morale was unusually high.

The orders percolated down from Hitler in December: a major air offensive was in the works, the largest yet, aimed at taking out the entire Allied western fighter force in a single day to be yet named. Concocted out of some sort of surrealistic dream that the Luftwaffe fighters on demand could accomplish in a single day what they had failed to do in two years, Operation Bodenplatte was doomed to failure before even a single Messerschmitt cranked up its engine.

The date for the massive assault was to be January 1, 1945. This date was chosen for two reasons. First, the weather had showed signs of clearing and appeared to be heading for clear skies on the 1st. Second, the German commanders felt that the "lazy Americans" would still be too drunk from their New Year's Eve reverie to effectively put up much opposition.

Reconnaissance photos were gathered and targets marked: Allied airfields dotting the German frontier and bases in Holland and Belgium. Information was delivered to the flight leaders, and they were instructed not to hold flight briefings until the last possible moment.

The morning of January 1 arrived, and nearly 1000 Luftwaffe pilots were roused from their sleep and told to prepare for a fight. Throughout the German airdromes, the briefings varied greatly. Some flight leaders merely told their pilots to "follow them" once airborne, while others ranted and raved like some manic football coach on the eve of a big game. One thing that all the briefings had in common was the lack of detail and truth that would have indicated to the pilots what the mission was truly about.

As the sky still hung dark, the Luftwaffe planes took to the air. Nearly 900 fighters from over 20 Jagdgeschwaders rumbled down dozens of airstrips and into the darkness (Goering later boasted that 2300 planes flew in the operation, perhaps to diminish the statistical magnitude of the German losses).

In the Face of Flak

Once in the air, the strikes against Allied airfields were to commence as a total surprise. The Luftwaffe fighters were to come in low and fast and strike simultaneously. Timing was crucial because many of the flight paths would take the Luftwaffe planes over their own airdromes, which bristled with flak towers. The flak gunners had to know when to expect overhead passes so they could hold their fire as the planes passed through their "free fire" zones. Unfortunately, operations did not go smoothly. Fog on one airfield delayed takeoff, and at others problems lining up on the runway or starting a plane all resulted in flight delays.

Figure 10-5

German flak tower at a concrete airstrip

These delays were not communicated to the flak gunners, and the results were catastrophic. German antiaircraft gunners faced hordes of unexpected planes and opened fire. Radio silence during the flight time—designed to ensure surprise—cost the pilots dearly. By the end of the morning, friendly fire had cost over 100 Luftwaffe planes, fully 10 percent of the entire operational force.

Over the Airfields

The massive German attack, which had not managed to garner the needed level of surprise, still shocked the Allied air commanders as hundreds of low-flying planes buzzed the treetops and opened fire on planes lined up outside the hangars. The Allied pilots were groggy from the night before but soon regained some of their composure and scrambled to get as many planes as possible into the air.

The dogfights occurred just above the treetops, and although the Germans flew with true aggressiveness, the inexperience of many of their pilots proved to be their undoing. Unaccustomed to such low-level maneuvering, many pilots flew their planes into the ground.

As the morning progressed, the heaviest attacks peppered the RAF air fields on the Northern Front with gunfire. By the end of the operation, the Germans had destroyed hundreds of Allied aircraft both on the ground and in the air. German reports placed the Allied losses at 500 planes while the Allies counted the losses at just under 200, with three-quarters of the destroyed planes belonging to the RAF.

From a purely line-item accounting of the planes lost, it was a nearly even trade with the Luftwaffe losing approximately 300 planes in the 4-hour attack. Both the German and the Allied forces could replace the lost planes with relative ease, but the greatest loss was that of the pilots. The Allied forces lost nearly 150 pilots and while this was a hearty blow, it represented only a fraction of their available pilot corps. The Luftwaffe, on the other hand, lost over 250 pilots, many of whom were veteran flyers and unit commanders. This figure (and not Goering's exaggerated one) represents the true magnitude of the loss for the Luftwaffe, whose pilot core had already bled white. The losses in pilots broke the Luftwaffe completely; never again in the 5 months left in the war could the German air force pose any serious threat.

Operation Bodenplatte would go down in history as a foolhardy and nonsensical operation that amounted to the suicide of the Luftwaffe.

From the Journal of Gerhardt Lichter

Oberleutnant; January 7, 1945

...the new year began with a call to arms, and we heard our briefing as we had bread and tea on the runway. My healing broken leg ached in the cold morning, and the warm tea soon grew cold. I was handed a photo of our target with the flight coordinates inked on the back. We were to strike at an American base in Belgium. As I showed the photo to my flight, the ground crews were hastily attaching bombs underneath our planes.

On the runway I gave final orders to stick close since the other pilots had not had time to take note of the coordinates. I wedged the photo into a crack at the edge of my instrument panel. The sun was still hiding below the horizon as we lifted into the air.

Looking back, I had no feeling for the scale of Hitler's bold assault, and I might have thought the Fuehrer mad had I known. Instead, I did as I was trained to do and followed orders.

At our first navigation point, we banked south and flew toward St. Trond airfield, and soon it was visible as a blemish among the gray winter pastures. We began our shallow dive, and I picked a far hangar. I ordered the planes to begin their attack. In a moment, as the flak began, I heard the radio reply "dropping ordnance, turning to engage." What? I thought to myself, but I was nearly on my target, receiving small-caliber fire as I let the bomb fall. The hangar was destroyed and I turned back and saw the Allied planes swarming over my comrades.

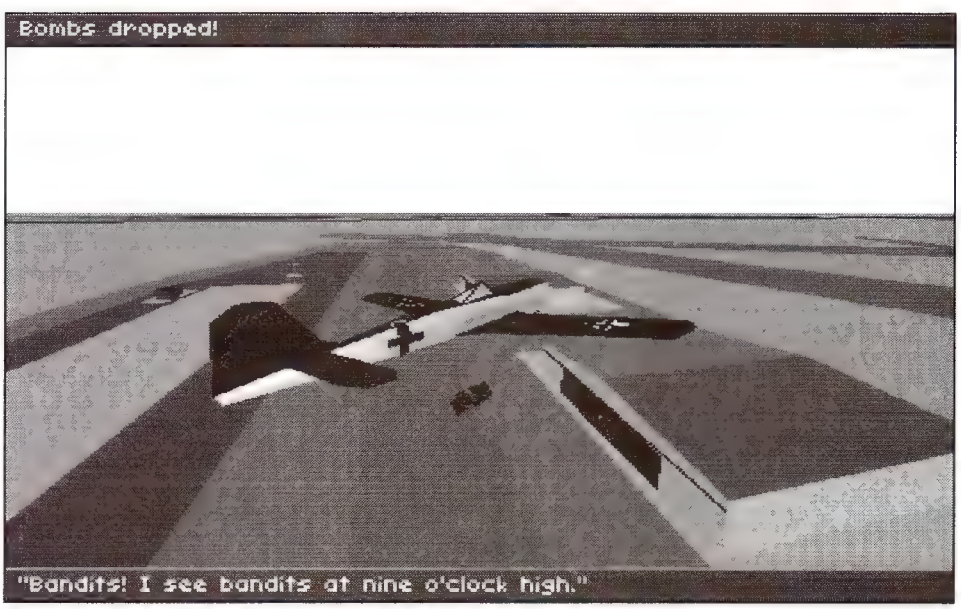


Figure 10-6

Taking out a hangar in Operation Bodenplatte

I reached for full throttle, armed my cannon, and closed for the kill. Immediately, a clean shot brought down a P-47 and I banked over to help out one of the wingmen, possibly Gunter. As I closed on his target he fell, crashing to the ground before he could escape with nothing but a black smoking pyre for his grave. I destroyed the P-47 and turned to another.

Gunfire surrounded me and I wove to escape. I called out to the remaining section to take out the hangars with cannon fire and gather on my wing. As I circled, I took down another American. Oil began to spatter my windscreen. Two more hangars gone and my flight turned to my heading, Erhardt falling as he attempted to climb.

Steinner tacked onto my wing and we climbed as fast as we dared. All the while I prayed my engine would allow escape—the temperature rising with the altitude. Turning my head, I could see the Americans still in pursuit as we reached 5000 feet.

I could not make it. My speed was falling. I radioed while Steinner was undamaged. I told him in the name of the Reich to return to the base and tell them of our victory. I would turn to fight.

I broke right through their bullets and shot down another plane that was climbing to attack. Then the world flashed white for an instant and something struck my arm. I could feel my arm throbbing as I attempted to bank. How odd, I thought, that the plane still flew as if on a rail as I watched its wings and side shred under the American bullets.

A white flash, and I knew the fuel tank had gone. Flames now flickered in through the shattered canopy and over the wings. I continued to bank, losing altitude. The bullets had stopped and I looked down at my feet, now wading in yellow—blue tendrils of flame as the fuel leaked into the cockpit. I punched the canopy release and it jerked open for a few centimeters. Then it stopped as the twisted metal caught on the fuselage. The heat welled up around me and I knew I must get out. The plane still fell in a graceful arc, not spinning at all.

I yanked my feet from the rudder straps, planted them on the burning cockpit floor, tucked my head, and thrust my entire body up into the canopy. It worked, and with a rush of air I was almost free. The wind nearly blinding me, I tried to pull my sleeve from the twisted metal when suddenly I was pushed over. I could feel the pop in the base of my shoulder as my body flipped out of the cockpit and hit hard against the fuselage. I was stuck there, my arm still caught. I grabbed my sleeve with my other arm and tugged and tugged as I closed my eyes. Suddenly, I was free, tumbling away from my burning Focke-Wulf. I reached across my chest as I fell and searched for the cord. Please, God, let my chute open...

FLY SINGLE MISSION: FLY A HISTORIC MISSION: LUFTWAFFE: THE LAST HURRAH!: ST. TROND WALTZ

Selecting The Last Hurrah! campaign from the Luftwaffe's historical campaigns allows you to fly five missions that occurred during Operation Bodenplatte. The missions from A Visit to St. Denis to Decision over Utrecht all take place on January 1, 1945.

St. Trond Waltz begins as a surprise raid to take out an American airfield in Belgium. When the planes of the JG-2 arrived, they found the American pilots already in the air and a fierce dogfight ensued that cost the Luftwaffe nearly 35 percent of its pilots. The Americans flew P-47s, which were no match for the German Focke-Wulf 190D9s, but their numbers and the support of antiaircraft fire evened the tables. Also, the Americans were able to see the German fighters coming and could set up in an intercept position with the knowledge that the enemy would have to get through them to get to the airfield.

This mission allows you to experiment with two tactics: dropping your ordnance before you get to the airfield and then turning to face the fighters, or trying to fly in and destroy the airfield first.

It is possible to take out the hangars and then gather your planes and make an escape with the mission ending as a success. In the actual battle, the Luftwaffe pilots were driven by a fierce determination to take out as many Allied planes as possible and

Figure 10-7

A low-altitude dogfight on January 1, 1945

although they were surprised, they knew their fighters were the superior weapons—the dogfight evolved into a full-fledged aerial brawl.

When you are battling so many planes at low altitude, be sure to keep one eye on the ground, one eye on your tail, another on your ammunition counters, and a fourth on your gunsights. By keeping all of theses factors in mind and flying with expert skills against the Americans, you should be able to do some serious damage. You need a little luck, though, and a strong performance from the other members of your flight to make it back alive after this grueling dogfight. Good luck!

Adolf Galland and Jagdverband 44

Goering was a man incapable of shouldering his own blame. He handed out condemnations as one hands out cigars. One of the Luftwaffe officers upon whom he placed heavy blame was Adolf Galland, whom he removed from office. Many Luftwaffe commanders instantly became furious with Goering and demanded an immediate audience with the Reichsmarshall. In a heated exchange, Goering was accused of falling asleep on the job and he angrily retorted "You're all mutineers!"

In reaction to the charges, an angry Goering had Galland removed from Berlin under house arrest. Word of the power struggle reached Hitler; and although he would not reinstate Galland, he did allow him to form his own fighter wing that would operate outside of Goering's and the Luftwaffe's command loop. Galland was allowed to select his own pilots, and a sinister Goering suggested that he recruit the "mutineers," thinking that the new jet fighter wing would be a certain death sentence.

Galland labeled the squadron JV-44 (the Squadron of Experts) and according to Galland, it truly became the most talented pool of fighter pilots ever assembled during the war. Galland chose the number 44—vierzig-vier—to symbolize two fuehrers. As Galland explained, "We decided that we had gone along with one fuehrer for 11 years and it had got us nowhere. We were going to try two fuehrers."

Located at the Brandenburg–Briest airdrome, JV-44 brought together the Luftwaffe's most skilled pilots and aces. Word of the squadron rippled through the Luftwaffe, and pilots deserted their own units for the opportunity to fly with Galland. Some

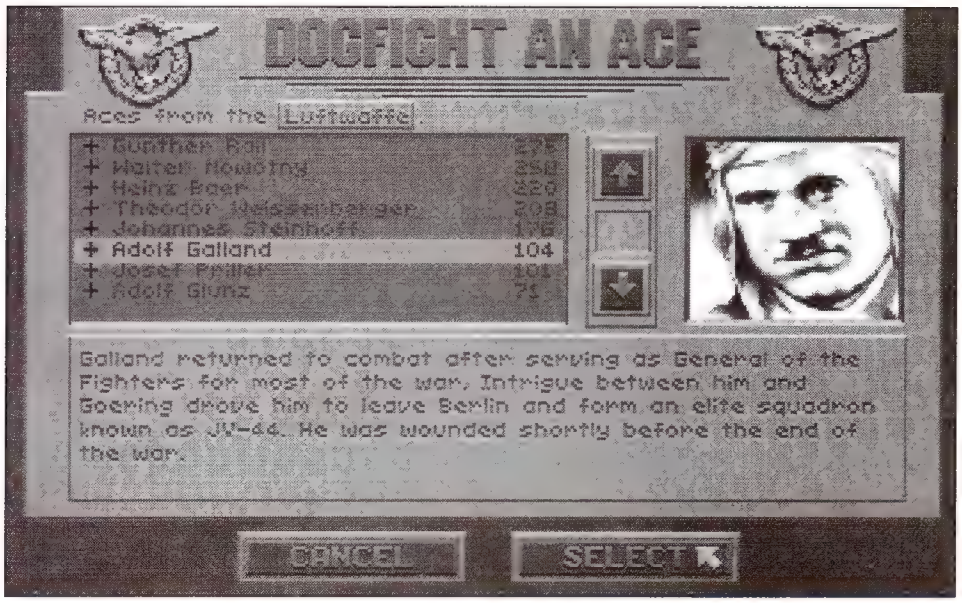

DOGFIGHT AN ACE
Aces from the Luftwaffe
+ Adolf Galland 104
Galland returned to combat after serving as General of the Fighters for most of the war. Intrigue between him and Goering drove him to leave Berlin and form an elite squadron known as JV-44. He was wounded shortly before the end of the war.
CANCEL
SELECT

Figure 10-8

Adolf Galland from the Ace Selection screen

even arrived on borrowed bicycles to join the fight. The pilots of JV-44 had scored a combined total of well over 700 aerial victories and Galland later wrote that the "Knight's Cross was, so to speak, the badge of our unit."

The JV-44 inflicted massive damage on the American bombers. The blending of the powerful Me-262 with pilots who could utilize each of its advantages to perfection proved to be a powerful weapon. On one day (April 7, 1945) the Me-262s of JV-44, armed with deadly R4M rockets, laid waste 25 American B-17s without losing a single plane. This deadly assault rattled the

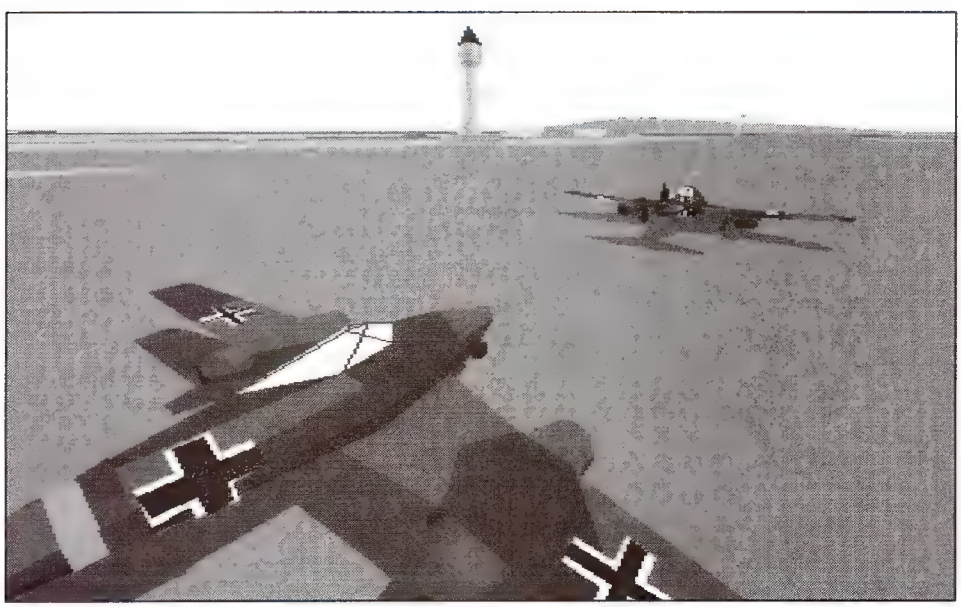


Figure 10-9

Me-262s of JV-44 ready to take to the air

bomber stream so much that the bombs were released prematurely, completely missing their intended targets.

Life for the pilots of JV-44 was an exercise in terror. The Luftwaffe still had no claims whatsoever for air superiority, and hordes of Allied Mustangs and Thunderbolts orbited the airdromes waiting for the jets to be brought out on the runway. Many were destroyed before ever becoming airborne. The runways were continuously pocked with bomb craters and hasty patches as ground crews worked around the clock to keep the airstrips serviceable. Takeoffs often occurred through a hail of enemy gunfire, and landing was an even more extreme exercise in terror.

For the Luftwaffe, although the efforts of JV-44 were impressive, they were not on a scale to change the tide of the war. It was like attempting to use an umbrella to shield an entire nation from a rainstorm. Still, it was a last bastion of skill, bravery, and gallantry for the Luftwaffe and the pilots who flew for Galland had a chance to fly as proud warriors at last.

Galland's flying days ended on April 26 when he was forced to crash-land his jet under heavy enemy attack. Wounded, he was taken to the hospital to sit out the remaining days of the war recuperating. When flying a career as a Luftwaffe pilot you have the opportunity to join JV-44 during the final campaign, The Last Hurrah!

Into Germany

On March 7, 1945, Bradley's 1st Army conquered the last major obstacle before storming the German homeland: the bridge crossing the Rhine at Ramagen was taken. The Americans immediately began pouring troops, tanks, and guns into Germany to establish a defensible position and a bridgehead that could be used to strike deep into the Reich.

Germany attempted to destroy the bridge at all costs and halt the American incursion, but all attempts proved futile. Divers tried to destroy the bridge with explosives but were shot out of the water. V weapons were aimed at the bridge but flew off course. The Luftwaffe sent in Me-262s and Arado bombers to drop explosives onto the bridge, but evading the American antiaircraft fire seriously hampered the aim of the bomb drops. Finally, the bridge did collapse into the Rhine. By that time, however, the Americans had claimed a defensible front and had breached

the river in other places. By the end of March, both Patton's and Montgomery's forces had crossed the river. The war was drawing to a close.

The Russian forces were closing in from the east, and all eyes were set on the German capital of Berlin. Eisenhower sent a communiqué directly to Stalin, indicating that Berlin was his if he wanted it. Churchill flew into a rage, but Eisenhower had authority over Churchill in this matter. He knew that the taking of Berlin would cost many lives, and he did not wish to sacrifice more Americans or British than necessary to achieve a goal that was inevitable. Churchill wanted Berlin for the prestige and for the advantage over Russia when the war ended, but the only man with authority over Eisenhower was Roosevelt, who lay on his death bed. Incredulous, Stalin was sure that the Americans meant just the opposite and increased the pace toward Berlin to beat their "little allies" to the capital.

Russia took Vienna on April 7. In the next week, President Franklin Roosevelt died. Truman assumed the presidential duties and saw the war to its close while the United States mourned the president who had seen them through two of the toughest struggles in the history of the world: the Great Depression and the Second World War.

As the Allied forces drove through the German heartland, resistance crumbled and Germans surrendered by the thousands. On April 21, the Russians first caught a glimpse of the German capitol and began their artillery barrage. Hitler, living in his secret

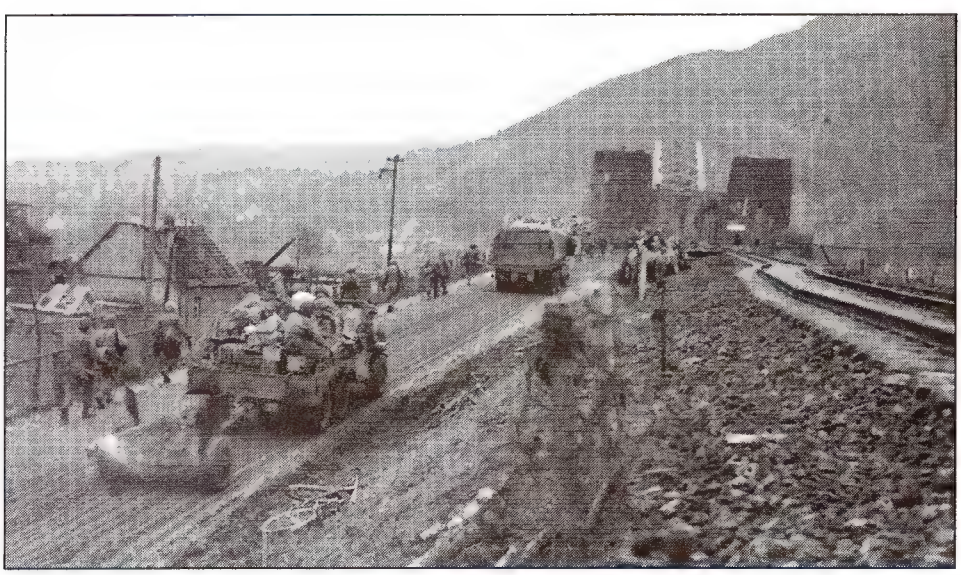


Photo 10-5

Allied forces move across the bridge at Ramagen.

bunker in Berlin, still barked out orders to his generals, who had no troops left to command. A manic Hitler even remarked "You'll see, the Russians will yet suffer the bloodiest defeat in their history at the gates of Berlin." In a conference with his senior staff on April 22, Hitler flew into an uncontrolled rage, screaming for the first time "The war is lost!"

The Russians entered Berlin on April 23, battling the remaining shards of Germany's once-mighty armies, now only old men and boys. The battles raged house to house, block by block with the Reichstag, the German capital as, their goal.

In his reinforced concrete bunker, Hitler knew that the end was near. He and his lover, Eva Braun, were married on April 29. They spent much of the next day preparing to die—Braun by cheerfully giving away her personal possessions and Hitler by formally saying good-bye to what was left of his staff. After an early supper, the couple shook hands with those remaining and retired to their chambers. Hitler's valet waited to hear the gunshot, but the walls were soundproofed. Cautiously, he opened the door to find Hitler lying dead from a gunshot to the head and Eva Braun curled up on the couch, dead from biting down on a cyanide capsule.

Only days later on May 1, 1945, Berlin finally fell to the Russian army. On May 7, Germany capitulated unconditionally. The war that had cost 50 million lives had finally ended.

Photo 10-6

Berlin lies in ruin, May 1945.

Photo 10-7

Field Marshal Wilhelm Keiter signs the German Instrument of Surrender on May 7, 1945.

Conclusion

The surrenders of Germany then Japan in the Pacific theater were the final punctuation on one of the most brutal and far-reaching of human conflicts. The Second World War had dragged on for years as a war of attrition, one that was marked by the sharp flash and rise of Germany's conquests and then as a long, bitter, and seemingly unending defeat.

Photo 10-8

A Focke-Wulf 190 lies abondoned, not even a distraction for a flock of sheep.

In the skies over Europe, fighter pilots flew and fought and died. All told, nearly 160,000 Allied airmen lost their lives. We do not know how many Luftwaffe pilots were killed or wounded. In retrospect, many of both the Luftwaffe and the Allied air forces' strategic decisions could be second-guessed, but hindsight cannot change history.

The Allied air forces had fought the air war in two different arms. The first was massive strategic bombing campaigns with hundreds of bombers—fighter escorts at their sides—that took aim at the larger issues of German industry and military preparedness. Month upon month of bombing raids ground Germany's industrial base into the dust.

In addition, Allied pilots had concerned themselves with the smaller pinpoint targets: the trains carrying German tanks and the airdromes that were home to the Luftwaffe. The multifaceted tactical air war had brought the power of aerial weaponry to bear directly upon the most immediate targets of the Allied offensive, and proved its value many times over.

For the Luftwaffe, what started as a vibrant, aggressive offensive strategy working in support of Germany's lightning armies had changed focus dramatically and become a reactionary force. Gone were the days of true German aerial offensives. In the last months of the war, attempts at bombing were weak and ineffectual. The ever increasing Allied aerial presence had forced the Luftwaffe to direct its efforts at stopping the bombers, but the cost had proved too great. Slowly, inevitably, the Luftwaffe had fallen into defeat.

Aerial combat has changed over the last 50 years as technology has improved. Today we have computers and radar systems in the planes to aid the pilots and crew. Giant bombers are no longer such a valuable commodity because today's fighter–bombers can deliver ordnance with building-to-building accuracy in deadly quantities. What has changed even more is the nature of air-to-air combat. Today's jet fighters commence an engagement miles apart, and the visual element of flying is no longer its most important facet. Missiles, deadly accurate in their homing abilities, can be launched miles before a visual identification can be made, and evasive maneuvers are more often carried out against missiles than they are against fighter planes bearing down on a pilot's tail.

In the Second World War, pilots relied on their wits and their senses. They were the central nervous system in the plane/pilot organism. Dogfights became organic affairs as each pilot tried to maximize his own plane's advantages in order to get a clean, low, deflection shot at his target. Never before and never since have pilots had such second-by-second control over deadly aerial weapons. Throughout the conflict, Allied and Luftwaffe pilots alike proved themselves determined above and beyond their own terrestrial abilities.

With the war long since over, we can look back and hope that a struggle of such magnitude will never again occur. Yet as the memories and stories of those who survived become more and more distant and exist only as words, what a powerful experience it is to step back into their shoes and relive their struggles, victories, and defeats.

Aces Over Europe gives you that experience. For a time you can be a fighter pilot and live through the seconds, minutes, and hours of an air-combat mission. You can learn and develop the skills and the mental abilities needed to perform in a dogfight. And even though you can experience the simulation as a mere game, you can choose instead to step back into the past, climb into the cockpit of a 2000-horsepower fighter aircraft, and claw into the air to meet an equally skilled and determined opponent. This is an opportunity for you to relive the actions and decisions of those pilots who flew 50 years ago, to gauge their experience against your own—and to see if you would have had the mettle to be counted as one of their own.

Getting the Most out of Aces Over Europe

There may be a boy here today who looks on war as all glory, but, boys, it is all hell.

William Tecumseh Sherman

Aces Over Europe is a rich simulation, full of a myriad of options, nuances, and situations for you to explore. Creating such a comprehensive simulation must have at first seemed a daunting task for the team at Dynamix, but the end result is something they can be truly proud of. More than any other flight simulator yet developed, *Aces Over Europe* places you within the planes and situations of the time and brings the aerial combat of the latter months of WWII into vivid focus.

Selecting Credits from the Other Options menu (accessed from the main menu) will bring up a photo of the entire *Aces Over Europe* team from Dynamix. Moving the mouse over an individual in the photo will display his or her name and role in the project (clicking the mouse will get you back to the main menu). In addition to the 23 Dynamix personnel pictured, well over a dozen other contributors ensured that *Aces Over Europe* would evolve into the simulation that you have in your possession.

Menus

Aces Over Europe allows you to navigate through the simulation by utilizing a series of nested menus that eventually lead you to an Activity screen that enables you to view and manipulate information and game options.

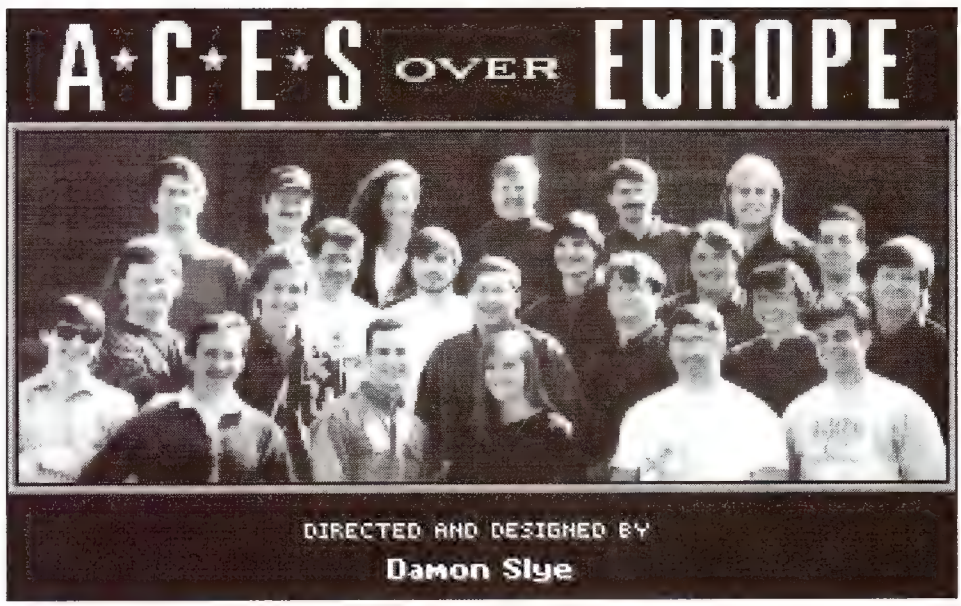


Figure 11-1

Dynamix *Aces Over Europe* team

Figure 11-2 illustrates the larger menu paths found in *Aces Over Europe*. This chart takes some liberty with the menu screens for clarity; for example, the Squadron Section screen you will see is not exactly the same as the Squadron Info screen; however, since the data displayed is essentially the same, it is considered a single stop within the simulations. The chart also does not display many of the intermediary menus that you encounter when changing a single game variable or performing such operations as selecting a service. Finally, for reasons of clarity it does not display the paths to return to previous levels. That option should be self-explanatory within the game.

Many of the areas you will visit in *Aces Over Europe* need no explanation, but several areas allow you to set up options and mission parameters. Discussion of these areas follows.

Mission Setups

In all of the single missions (with the exception of the Fly a Historic Mission option) you are eventually presented with the Mission Setup screen, which displays the type of mission that you are about to fly, a color photo representing the mission type, and a short description of the mission parameters. The words that are highlighted are the options that you may elect to change before entering the cockpit or continuing to the Mission Briefing screen.

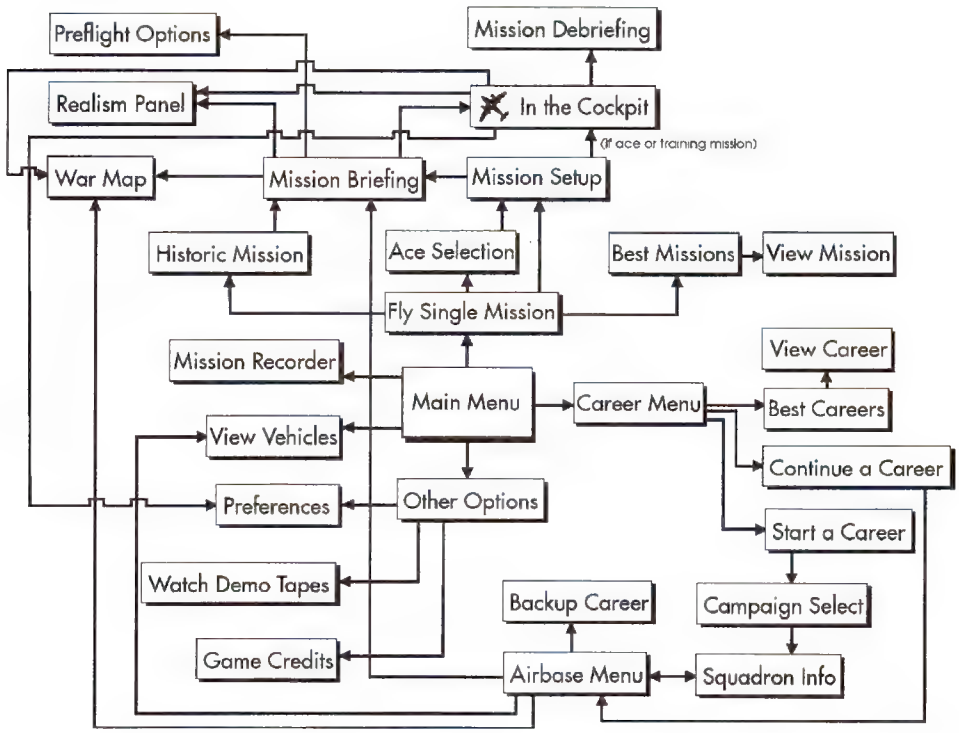


Figure 11-2

Menus and information areas within *Aces Over Europe*

You control the number of planes in your flight by clicking on Flight, which will bring up a control menu allowing you to select the number of planes in your flight (from one to four) by clicking on the highlighted number box. When you click on the boxes that represent the other pilots in your flight, you can select their skill levels (see Appendix B for further details concerning

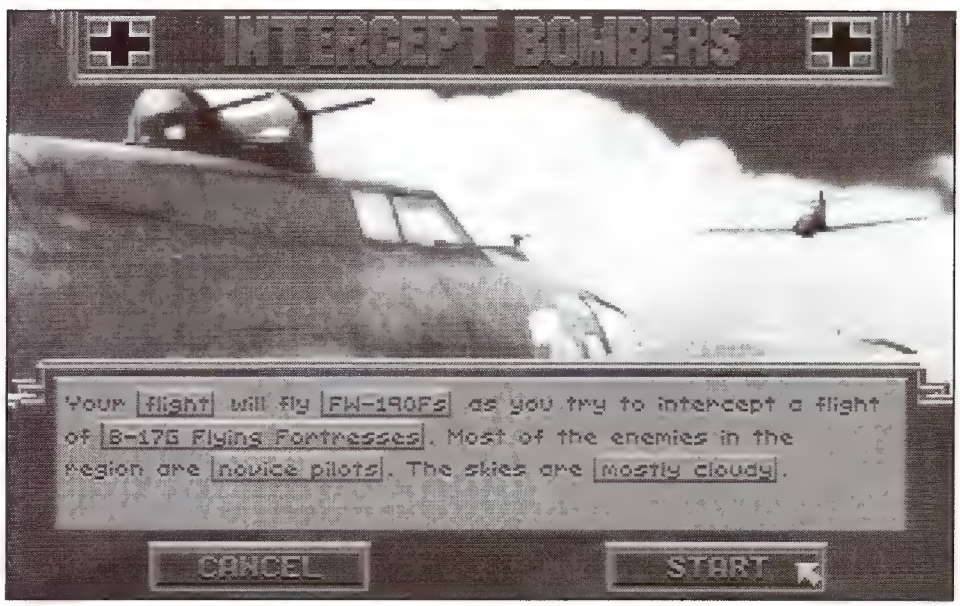

INTERCEPT BOMBERS
Your flight will fly FW-190Fs as you try to intercept a flight of B-17G Flying Fortresses. Most of the enemies in the region are novice pilots. The skies are mostly cloudy.
CANCEL
START

Figure 11-3

Mission Setup screen for a Luftwaffe Intercept mission

computer-controlled pilots), ranging from Novice to Expert. You may also select an individual ace to become a member of your flight.

The planes flying in the mission for both your wing and those of the enemy can be selected by clicking on the plane descriptors. This will bring up a list of all the planes available for you or your enemy to fly. Clicking on the last highlighted word allows you to choose the general weather conditions for your mission. When flying a training mission, after you have selected the service for which you will fly, you may select only the type of training mission that you would like to fly. The other mission variables remain standard.

Mission Briefing

The Mission Briefing screen provides you with a more detailed description of the particular mission objectives than does Mission Setup, including the date of the mission. From here, you may select Flight Map to review your flight plan and check out any recon photos of ground targets that you may be asked to strike. The Mission Briefing screen also allows you to access the Preflight Options and Realism displays, which are described below.

Preflight Options

The Preflight Options screen provides vital technical data concerning your mission. Here you can look over your plane type,

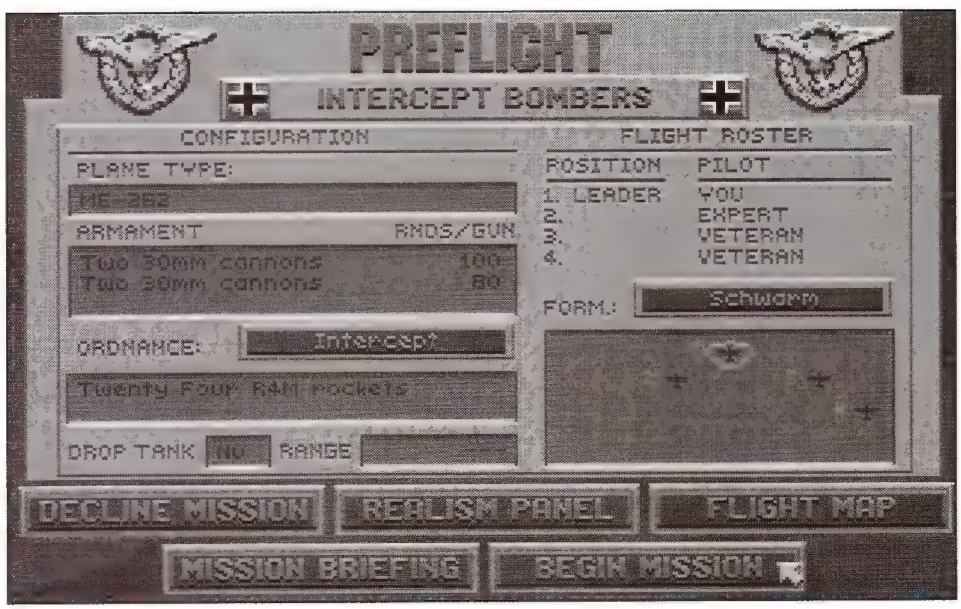


Figure 11-4

Preflight Options screen

armament, and additional ordnance that you may be carrying. You can also check to see if you will be flying with a droptank.

Then you are presented with a roster of your flight and a display of the formation that you will be expected to hold during your mission. If you are flying as a wingman or section leader (plane number 3), you will only be able to look over the preflight setups and will not have the ability to change any of the options. If you are flying as the leader, then you may select the type of ordnance your flight will carry as well as what formation your wingman will hold.

Realism

You may access the Realism Panel from the Other Options menu when at the main menu or select it from the Mission Briefing screen. You may also bring up the display from within the cockpit by pressing Alt - R.

The Realism Panel allows you to adjust the simulation to your own tastes by toggling the Realism settings either on or off. You may also select the Combat Level and the Flight Model that you prefer. After you have adjusted the settings to your liking and having clicked on Select, the settings are saved until you change them again. Restore cancels any changes that you have made since calling up the Realism Panel. Once your mission has begun, you have 30 seconds within which to change your Realism settings before the Difficulty factor will be utilized to affect your score.

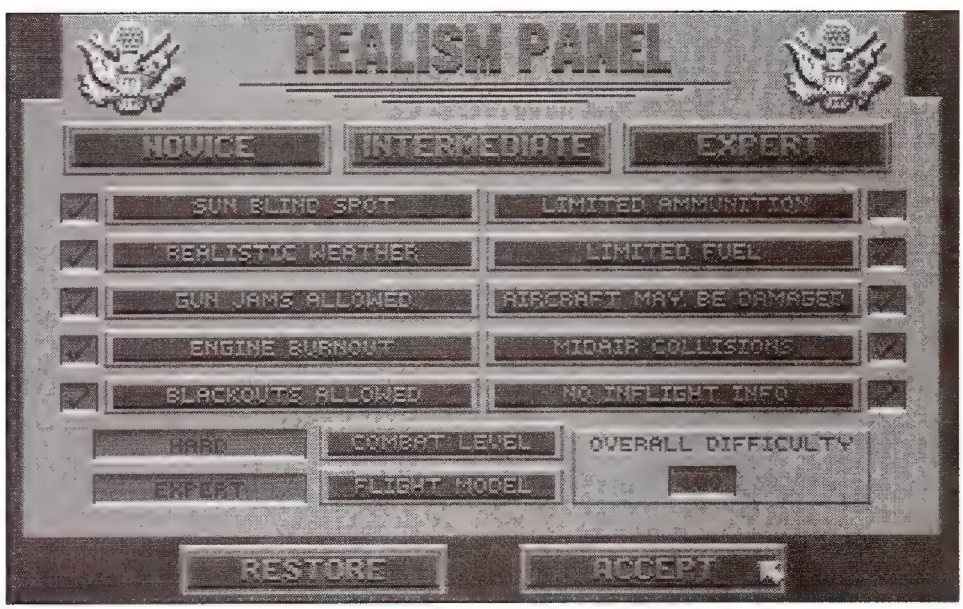


Figure 11-5

Realism Panel set up for Maximum difficulty

The panel displays an Overall Difficulty score that may range from 0 to 100. When you are flying a mission, points that you earn will be reduced by your Difficulty level using it as a percentage of points awarded. For specific point information, turn to Appendix B.

Each of the Realism toggles turns a flight restriction either on or off, making your flight either more realistic (and hence more difficult) or easier by giving you a break (such as eliminating the worry about midair collisions). A check mark by an option indicates that it is in force. Each Realism toggle affects the difficulty rating of your flight by a fixed percentage; these options are described next.

Sun Blind Spot

Relative Weight: 6 percent

The Sun Blind Spot toggle allows the sun to affect both you and the other pilots in a realistic manner. If this toggle is turned off, the sun is just a yellow circle in the sky, useful only for indicating time of day. Turned on, the sun blinds you as you look toward it and renders planes between you and it temporarily invisible (until they move from this line of sight). As mentioned in Chapter 8, the sun can prove to be of great tactical advantage when you are attempting to surprise an enemy.

Realistic Weather

Relative Weight: 6 percent

Selecting the Realistic Weather option allows weather to slightly affect the performance of your plane and also gives you the ability to duck into clouds (remember, so can your opponent). It also affets your long-range visibility. When this option is not selected, the skies will remain clear.

Gun Jams Allowed

Relative Weight: 6 percent

Occasionally during WWII, a shell casing would fail to eject properly and a pilot's guns would jam and fail to fire in the heat of combat. With the Gun Jams Allowed option selected, you will be faced with the remote chance that your guns might jam at any given moment. If they do, tap the [U] key to attempt to free up the firing mechanism.

Engine Burnout

Relative Weight: 6 percent

Although the Engine Burnout option does not affect your score by any greater magnitude than Gun Jams or Realistic Weather, toggling this option on and ignoring your engine's temperature warning light is tantamount to suicide. If your engine runs hot, you begin to rack up engine damage critical hits, reducing the maximum rpm—and hence the maximum speed—of your plane. Once you see the warning light, you must reduce your throttle within 30 seconds or risk permanent engine damage.

The flight model in *Aces Over Europe* tends to treat engine burnout more harshly than was actually the case in the war. Late warplanes were often equipped with a temperature-managing device that would help reduce dangerous engine operating temperatures by gradually adjusting the throttle levels automatically.

Blackouts Allowed

Relative Weight: 6 percent

With the Blackouts Allowed option toggled on, pulling excessive *G*s in a tight maneuver might very well cause your pilot to black out. If the screen begins to fade to darkness, ease up on your maneuver to clear your pilot's head. Should you black out, you may still control your plane even though the screen is black. Level out, fly straight, and in a few seconds—if you are lucky enough not to be shot to pieces—you will regain consciousness.

Limited Ammunition

Relative Weight: 16 percent

Selecting the Limited Ammunition option means that you have exactly as many rounds left in your guns as your ammunitions counters on the instrument panel indicate you have. Some planes, especially the Bf-109G, are notoriously stingy with ammunition loadouts, so managing your firing is an extremely important priority. Other planes, such as the P-51D, have very deep ammunition stores that allow a little more cavalier approach to your targeting and firing.

Limited Fuel

Relative Weight: 6 percent

With the Limited Fuel option selected, your plane can fly only a limited range, and you need to keep an eye on your twin-needled

fuel gauge. With low fuel reserves, you must think twice about chasing an enemy. Your engine stops when you completely run out of fuel and forces you to make an emergency landing (or crash landing if you are not so lucky). On single missions, even those that range over 1000 miles, fuel is unlimited and the maximum overall difficulty is 94.

On a single mission, even though you may initially be set up for a long-range strike, you will not need an External droptank. Either drop the tank immediately upon takeoff (D) or select the short-range loadout from the Preflight Options screen for the mission that you are flying. Your plane's performance will improve noticeably.

Aircraft May Be Damaged

Relative Weight: 80 percent

Obviously Aircraft May Be Damaged affects the overall difficulty of a mission by the greatest amount. On one extreme you may roam freely with the glint of invincibility in your eye, and on the other every shot from an enemy plane could end your career. Toggling this option off will leave your plane impervious to damage from enemy gunfire, which is useful when practicing certain tactics such as attacks on bombers when you would like to make several passes without the fear of being downed. It is recommended, however, that you leave this option enabled because doing so provides the most realistic sense of the merit of evasive maneuvers and defensive flying.

Midair Collisions

Relative Weight: 6 percent

The Midair Collisions option can be far more costly than merely a 6 percent drop in your Difficulty and your mission score. With the option toggled off, you may pass through another plane like a specter, damaging neither plane. With this option enabled, a collision with another aircraft will most certainly send you tumbling earthward. This is another recommended option because it requires you to take into account the physical presence (and inertia!) of another aircraft.

No Inflight Info

Relative Weight: 3 percent

Toggling off No Flight Info eliminates the helpful inflight messages that appear at the top of the screen—most notably the suggestion to Pull Back on the Stick when preparing to take off.

Combat Level

Relative Weight: 14 percent (Easy), 6 percent (Standard), no reduction (Hard)

The combat level options allow you to adjust the precision level of aiming necessary to hit an enemy plane. As mentioned in Chapter 8, *Aces Over Europe* uses invisible "boxes" to represent a plane's target areas. When the combat level is set to Easy, the boxes on enemy planes are larger, making them far easier to hit. When set to Easy, the target areas are three times larger than when the combat level is Hard.

The combat levels also affect how much damage your plane can sustain as well as the effectiveness of enemy flak bursts (which are totally ineffective at the Easy setting). At the Hard level, you and your enemy face off on a level playing field—it is just as hard to hit him as it is for him to hit you.

Flight Model

Relative Weight: 14 percent (Novice), 7 percent (Intermediate), no reduction (Expert)

The Flight Model setting allows you to adjust how realistically your plane reacts to the physical forces of flight. When set at the Novice level, the plane is a docile flyer. Turns are easily performed without any loss of altitude or natural "nose down" tendencies that require rudder compensation. Upon landing, your gear is automatically lowered. When flying with extra ordnance such as bombs, rockets, or an external tank, your plane will still fly "clean" as if there were no additional forces of drag affecting your flight. Although flying at Novice level equalizes many of the quirks found in the different planes, it does not change the plane's general performance levels. A P-51D will still be able to turn sharper than a Bf-109.

At the Intermediate Flight Model setting, the plane performs much more realistically. The general forces of drag are considered, and your plane noses down during a turn. You will have to utilize your rudder to apply back pressure during tight maneuvers. Landing is more difficult, and you will have to remember to lower your own landing gear.

The Expert setting conveys the most realistic sense of flight possible, taking into account the subtle quirks of the individual aircraft (like the P-38's penchant for compressibility problems during a steep dive). Landing is more challenging, and your plane performs realistically through turns, speed variations, and altitude changes.

Adjusting the Simulation to Fit Your Machine

You may access the Preferences panel from the Other Options menu, or you may reach it by tapping F10. This panel allows you to customize the *Aces Over Europe* environment to fit your liking or to fit the equipment that you have available to you. The options are largely self-explanatory.

When you access the Preferences screen from the cockpit, you are presented with a more detailed array of options than you are when you access it from the Other Options menu. As with the standard Preferences panel, you have the option to select the flight controls (for more information, see Appendix D). Only the flight controls that are valid options will be displayed. You may also select Calibrate to calibrate the external controllers that you have selected (you do not need to calibrate the mouse or keyboard).

The most important controls appear on the right side of the panel and allow you to tailor the simulation environment to best match the speed and resolution of your individual computer.

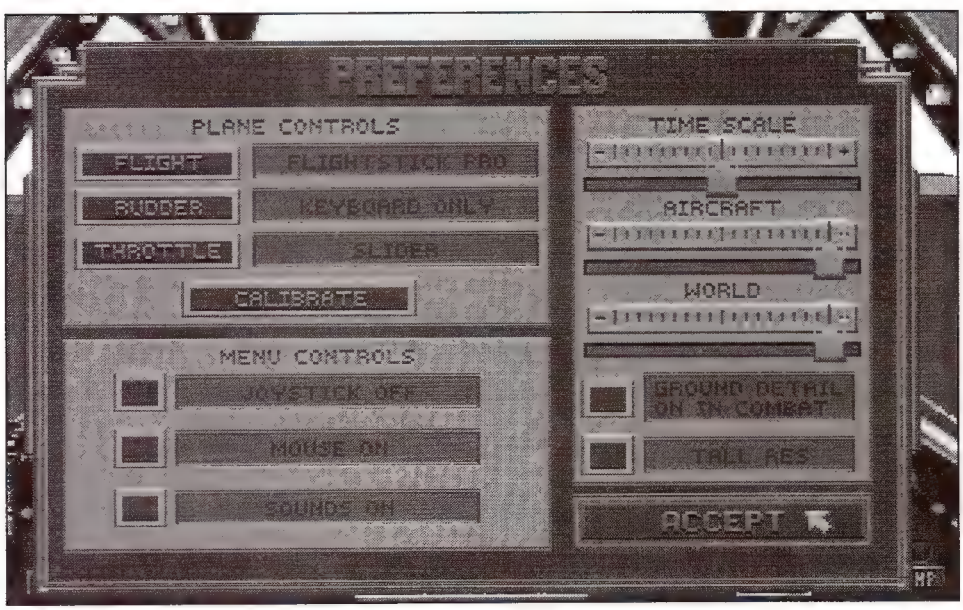


Figure 11-6

Preferences panel, when accessed from within the cockpit

When you first installed *Aces Over Europe*, the simulation set up the various details and time levels to best correspond with the stock speed of your machine and to achieve the closest approximation of real time.

Aces Over Europe displays the world outside of your cockpit by processing frames of animation. The simulation basically does two things at once. First, it maintains and updates a *world database* that contains information such as what planes are where and the location and state of the multitude of ground operations. As you fly, this world database is modified to reflect the change in position of your plane.

Beyond just the number crunching, the simulation creates visual displays corresponding to what is happening in the purely numerical world database. An enemy plane, which is actually a complex arrangement of polygons, is drawn to represent what you see out of your cockpit. This process of adjusting the database, then calculating the view, occurs continuously when you are flying. By breaking the world and the graphic display up into separate units, the simulation is extremely efficient and can perform such impressive tasks as offering a panning External view of your plane as you duke it out with a Focke-Wulf.

Time Scale

The graphic frames are not calculated at every instant because to do so would mean that the computer would never catch its breath long enough to actually display the images. Instead, graphic frames are built from the world data at discrete time intervals. You may control these intervals by adjusting the Time Scale slider on the Preferences panel.

Moving the Time Scale slider to the left decreases the time interval between calculations, effectively presenting you with a more accurate representation of what is happening in the world database than you experience when the slider is more to the right. Unfortunately, this requires much more intensive computations so the simulation slows down. If you move the slider too far to the left, you feel like you are flying in pea soup.

Conversely, moving the slider to the right increases the time interval between calculations and makes the simulation appear to speed up. If your computer is a 486, it may even become too jerky and fast to control. Essentially, more is happening within the *Aces Over Europe* world in between each frame, so the display

will represent changes in state (such as a tightly banked turn) much more markedly.

None of the settings on the Preferences panel actually alter the frame-rate of your computer; that is mandated by the speed of the processor and the ability of the graphics card. You can, however, alter how time is represented in each frame your computer displays, and that is adjusted by utilizing the Time Scale slider. The Time Scale, when used in conjunction with the other controls, allows you to adjust the simulation so that you can achieve the most realistic senstion available from your own computer.

In addition to using your mouse cursor to adjust the sliders, you may place the arrow pointer over the slider you wish to adjust and then adjust it by tapping the left and right cursor keys on your keyboard.

Occasionally you will find yourself embroiled in a mission with the sky virtually littered with planes. When this occurs, you will notice that the simulation slows down considerably as your computer struggles to compute the actions of the myriad of planes. Once you become familiar with aerial gunnery and deflection shooting, you will note that this change in timing can have a considerably adverse effect on your aim. By bringing up the Preferences panel (F10) and moving the Time Scale slider slightly to the right, you should be able to get the simulation to return to your familiar feel. When you have dispatched the denizens of the air, return to the Preferences panel and adjust the Time Scale back to its original level.

Other Detail Controls

The Aircraft and World Detail sliders allow you to adjust the level of detail with which the graphics portion of the simulation renders the various features of the game. By reducing the level of detail (moving the sliders left), you are lowering the computational strains on your processor and thus will achieve smoother animation.

When you adjust the Aircraft slider to the higher detail setting (moving the slider right), the planes show their squadron markings and are drawn utilizing Gouraud shading, which more accurately simulates the change in shadows across the curving fuselage of an aircraft.

The Ground Detail toggle allows you to turn off the computation and display of ground detail when you are involved in aerial battle. Such things as roads and rail lines will no longer be seen from the air.

The last button on the Preferences panel allows you to toggle between Normal and Tall resolution. Normal resolution will display 320 × 200 pixels when in flight while Tall resolution will increase the smoothness and the level of detail by displaying 320 × 400 pixels. This setting only affects the display when in flight. All other displays are shown in 320 × 200 resolution.

View Controls

By now you have learned that *Aces Over Europe* provides you with five Internal views (F1 through F5) and six standard External views (F1 through F6). To switch between Internal and External views, simply tap Enter. When you are in the External viewing mode, you may zoom out by tapping the] key and zoom in by tapping [. You may only zoom in until the plane occupies roughly 1/3 of your screen (in length). The only way to get a closer view is through the independent camera controls from within the Mission Recorder (see Appendix A). In addition to these set views, the simulation provides two unique external views: the Chase Plane view and the Weapon view.

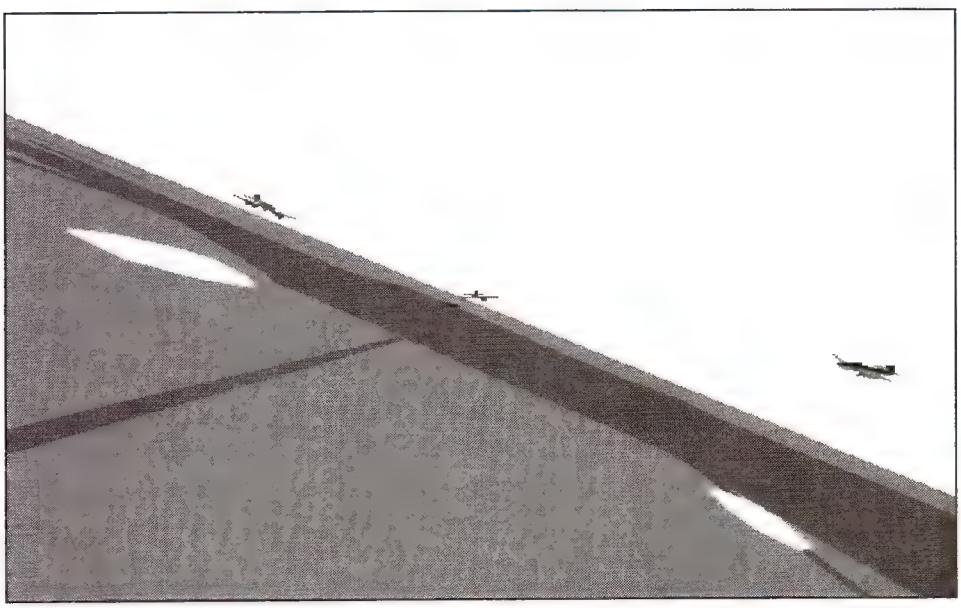


Figure 11-7

Chase Plane view following an Me-262

Chase Plane View

Tapping F7 will present the Chase Plane view. This can be accessed from either the Internal or External views. From the Chase Plane view, you see your plane as if you were observing it from another plane flying behind and slightly above your plane. If you slow down, your plane will appear to get closer to the chase plane until it appears that your plane is perhaps 80 to 100 feet ahead. Accelerating increases the distance between your plane and the chase plane until the distance appears to be between 500 and 600 feet; then the chase plane will match the speed of your aircraft.

The chase plane will follow your plane and perform each maneuver you perform but will do so approximately 1.5 seconds later. This makes the view impractical for dogfighting but interesting when practicing aerial maneuvers or flying in formation. Using the Chase Plane view and performing banks and turns while firing your guns gives you a very good view of the parabolic path your bullet stream takes and makes an excellent aid in practicing deflection shooting in the Aerial Gunnery training mission.

Weapon View

Tapping F8 after you have launched external ordnance such as a bomb or rockets gives you a viewing angle that follows the course of the weapons from several feet. This view is a very

Figure 11-8

Weapon view of a pair of bombs heading for a truck convoy

dramatic presentation of the effectiveness of your ground attacks and allows you to see just how dead on or far off your targeting was.

While in Weapon view, your plane is still flying and therefore subject to control movements and vulnerable to enemy fire. Being lured into watching the Weapon view while initiating a dive-bombing run can yield disastrous results if you neglect to pull up before your plane plows into the ground.

Floating Camera

When in the External views, you may opt to manually adjust the free-floating camera. If you are using a joystick for flight control, hold down button 2 and move the joystick to rotate the free-floating camera. If you are using a mouse for flight control, holding down the right button and moving the mouse allows you to change your view.

You may rotate the camera to any point around your aircraft. (When on the ground, you may only move within the hemisphere above your aircraft.) The camera will always remain pointed toward your plane.

The Aces Over Europe *manual incorrectly informs you that you may zoom in and out by holding down joystick buttons 1 and 2 simultaneously and moving the stick forward and back. In actuality, all you will do is fire your guns while panning. You must use the keyboard commands to zoom in and out.*

Creating Custom Views

Aces Over Europe gives you the powerful option of creating and saving your own customized External views. Simply rotate the free-floating camera to the position you would like (you may also adjust the zoom level) and hold down the Ctrl key while tapping one of the function keys (for example, Ctrl - F3) to save the view. You may then return to this view any time by holding down the Alt key while pressing the function key again. The views will remain saved as long as you are within the simulation; they are lost when you exit to DOS.

This is an extremely useful function because you may create External views that allow you to quickly check your plane's blind spots while in combat. Setting up a view that looks behind and

below you is a great way to check for bandits sneaking up. You also might want to create both a forward and a backward view that are zoomed back substantially to allow you to get a quick bearing over the entire aerial battlefield.

Making Your Flying Experience More Enjoyable

The complexity of *Aces Over Europe* makes it an incredibly rich gaming environment, one in which you can easily become immersed for hours on end. There are so many ways to enjoy the game and so many ways to enhance your experience. Playing is just the beginning; the play is enhanced by reading books on the history and aircraft represented in the game. You could even set up your gaming room to resemble a cockpit. The options are almost endless.

A Word on Controls

Aces Over Europe allows you to control your flight in numerous ways. You may use the keyboard or the most advanced joystick and rudder pedal combinations. For a more detailed description of the control options, see Appendix D.

One point should be stressed, though. Use the best quality controller you can afford. While flying with a cheap joystick may seem a step up from tapping the keyboard, the feel and control you experience with a quality controller will be well worth the price. Your movements are smoother and flying your aircraft is markedly easier when utilizing a quality joystick.

The controls found on the actual planes were hefty, hand-filling joysticks that were sometimes mounted directly on a control base and other times were long shafts mounted to the floor of the cockpit. (With some searching, you may even be able to track down a genuine controller from a war-surplus outlet.) Therefore, using a large joystick that fills your hand gives you a more realistic feel. Although smaller pad-type controllers and small thumb-controlled joysticks may be high-quality controllers for arcade-type games, they just don't impart the same feel as a larger, solid joystick.

A Word on Sound Cards

You do not need a sound card or external speakers to play *Aces Over Europe*, but having a quality sound setup will most certainly enhance the experience. *Aces Over Europe* does not need

an expensive 16-bit sound card; a quality 8-bit card will do quite well. Having a decent set of self-powered external speakers, ones that will provide a deep bass response, will give you the most realistic sounds.

Placing the speakers on each side of the monitor (or better yet on the floor facing up toward you) will provide the most realistic acoustic environment. The new generation of three-piece speaker systems featuring two satellite speakers and a subwoofer provide the most spectacular sound of aerial combat.

If you are playing late at night, a good pair of headphones is a must. Seek out comfortable, full-enclosure phones that cup your ears and are comfortable to wear for long durations. The small, Walkman-like headphones just can't deliver the depth of sound the full enclosure units can. You might also want to track down an external potentiometer (Radio Shack is a good place to go) so that you can control your headphone volume without fumbling around with the little sound board volume dials on the back of your computer.

An Advanced Flight Log

In Chapter 6, you read about the usefulness of maintaining a flight log to record your impressions about the various planes that you fly. Keeping such a log can do a great deal to enhance your enjoyment of *Aces Over Europe*. Although you can access many facts and figures about the planes in the View Vehicles database, you have no record of your subjective impressions. Also, while the Debriefing screens provide you with an overview of your mission performance, they do not tell you the specific ground or air targets you took out or the trials and tribulations you experienced during the flight. Consider setting up a log that expands the Mission Debriefing screens and provides you with information about each mission.

Setting up a log for a flight career can be a great way to follow in detail the progress and advancement of your pilots through the ranks. You might want to devote an entire page to creating a fictional background for your pilot. Where was he born? What is his nationality? How does he feel about combat flying and clashing with the enemy? Taking a few moments to jot down observations about your pilot allows you the luxury of role-playing when you step into the world of *Aces Over Europe*, and gives you a deeper attachment to your pilot and his performance.

Name: _____

Age: _____

Birthplace: _____ Nationality: _____

Brief Personal History: _____

_____

_____

_____

Service: _____ Date Entered: _____

Rank: _____

Campaign: _____

Squadron Info: _____

Missions Flown: _____ Successful Missions: _____

Aircraft Kills: _____ Ground Strikes: _____

Medals Earned: _____

Description of Medal-Earning Actions: _____

_____

_____

_____

Promotions: _____ Date: _____

Reassignments: _____ Date: _____

Most Memorable Missions: _____

_____

_____

_____

_____

_____

_____

Illustration 11-1

Sample pilot log

Pilot: _____

Service: _____

Squadron: _____

Date: _____ Time of Day: _____

Briefing: _____

_____

_____

Plane: _____

Loadout: _____

Flight Notes: _____

_____

_____

Unexpected Encounters: _____

_____

_____

Results: _____

_____

_____

Successful Strikes: _____

Remarks: _____

_____

_____

_____

Mission Comments: _____

_____

_____

Success? _____ Points Earned: _____

Illustration 11-2

Sample mission log

In addition to a pilot log, you can create a mission log. It might take some time to remember to pause long enough to record your observations about each mission, but the rewards you reap will be well worth your efforts. Here is where you can store not only your observations but also your acts of uncanny ability and heroism—and don't forget those learning experiences called mistakes.

Other Resources

Enhance your enjoyment and appreciation of *Aces Over Europe* by learning as much as you can about the air war, the planes, the pilots, and the tenor of the times. Contact your local VFW chapter to find out if there are any pilots in your area to whom you might talk. The best way to bring the experience to life is to meet these veteran pilots and hear their stories.

An exciting way to learn about the planes is to attend regional air shows that feature historical planes—your local airport is a good source of air show information. Nothing can quite compare to getting up close to a real war bird or seeing a restored plane take to the air.

Books

Take a stroll to your local library to see what books on WWII air combat it has on the shelves. If its holdings are sparse, ask to see the *Books in Print* volume that classifies books by subject. When you find some interesting titles, your librarian can place an interlibrary loan request for you.

Personal accounts generally make the most fascinating reading. Rather than dealing with the war in historic generalities, focus on individual personal experiences. These written personal accounts are the next best thing to a live storyteller.

If you have a large library nearby, seek out the old periodicals from the war years. Flipping through the weekly articles can give you an idea of how the war was progressing (and also how propagandized the coverage was). Advertisements of an era always give you a real flavor of the culture as well.

Videos

Many historical and special-interest publishing houses now offer videos that present the actual newsreels and wartime films made during the conflict. You should be able to track down quite a few

films that were made by the USAAF's film division. They produced training films (now unclassified) and general-interest films meant for the civilian population. Because June 1994 was the 50th anniversary of D-Day, most major television networks put together documentaries about WWII. The recent vintage of these programs gave them a fresh, enlightening viewpoint. Your neighborhood video store may be able to help you locate these productions. There are historical, special-interest magazines that provide you with ordering information for a number of video vendors. Challenge Publications (7950 Deering Avenue, Canoga Park, California 91304) publishes a number of magazines dealing with historical airplanes and air combat.

On-Line

The larger on-line vendors (CompuServe, GEnie, Prodigy, and America OnLine) each have extensive special-interest areas devoted to computer games. Using the on-line services, you can link-up with other *Aces Over Europe* players to share tips, observations, and Mission Recorder tapes.

The Flight Simulation forum on CompuServe is perhaps the largest special-interest group devoted specifically to computer flight simulators. Within the forum, the Historical Simulations area (both Library and Conference) is the place to meet with other *Aces Over Europe* enthusiasts. The Library (Library 7) contains text files, help files, unofficial "patches" (see following note), and Mission Recorder tapes.

A patch *is a program code that modifies your* Aces Over Europe *simulation in different ways, from allowing you to set up "cheats" to altering the performance abilities of various planes. The unofficial patches and "hacked files" that you can find in the on-line libraries of CompuServe and the other on-line services (as well as many regional BBSs) are not supported by Dynamix. For this reason, you should always make a safe copy of any files you are attempting to modify to protect yourself and to ensure that you will always have a clean official version of the* Aces Over Europe *files.*

Dynamix does not frown on "hackers" getting into their code and creating their own patch files, however, and that is why the AOE data files are not encrypted. In fact, in the words of a member of the Aces Over Europe *design staff, "We all think they're pretty cool."*

Dynamix maintains a publishers forum and library within the Game Publishers C forum on CompuServe. Here you can e-mail questions and observations about the simulation and download official patches or program updates.

Models

Although you can check out your plane in the View Vehicles database or in flight and get an excellent idea of how the plane actually looked, computer technology limitations mandate that the image is less than photo-realistic. Building a plastic model of the plane, though, can give you an excellent idea of how the plane looked.

You get a real sense for the planes in *Aces Over Europe* by collecting and building models. Monogram Models offers a series of 1:48 scale models of many of the planes you encounter within *Aces Over Europe*. Stop by your local hobby shop or write to Monogram Models, P.O. Box 68849, Schaumburg, Illinois 60194, for a catalog.

A Final Word

Aces Over Europe allows you to step back into the past and relive some of air combat's most exciting moments. Although it's just a computer program, it seems to transcend those bounds and becomes more than that—it becomes a vehicle for your imagination, a ticket to a past life full of danger, challenge, and excitement.

More than anything, though, the point is to have fun. Let yourself become immersed in the simulation. You're a WWII fighter pilot taking to the windy ether in search of a flock of bandits to tangle with. Check six, shoot straight, and Godspeed.

Mission Recorder

Perhaps one of the most exciting aspects of *Aces Over Europe* is the sophisticated Mission Recorder. Think of it as a micro-movie studio that records every aspect of your mission and allows you to create films that serve a variety of purposes.

Essentially, the Mission Recorder serves three main functions. First, it is a training tool because it affords you an opportunity to review your mission performance from a multitude of perspectives. Second, it becomes an artistic tool with which to create exciting and dramatic films of your protagonist. Finally, it is bragging irrefutable evidence of your moments of valor, cunning, and courage.

At the end of each mission, you have the opportunity to save the mission to tape. Select Save Mission To Tape option, provide an eight-character name, and click Save. Then you may enter the Mission Recorder from the main menu screen.

How It Works

If you examine the TAPES directory from DOS, you will note that the size of a recorded mission is significantly smaller than you might think. This is because the tape is not an actual frame-by-frame film but merely a recording of an initial "state" and the ensuing control movements.

Each mission you fly fills out a certain set of parameters that represent the state of the simulation at the time the mission commences. This information is comprised of such things as the amount of fuel in your plane; facts regarding other pilots in your flight; enemy plane numbers, locations, headings, speeds, skills, etc. Basically, every variable you can imagine that could describe the details of your mission is part of a mission's state.

When you begin flying, the simulation keeps track of every control move you make from pulling the stick back to throttling up; from firing your guns to looking left out the cockpit. All of this information is stored in a data stream. When you save a mission to tape, the initial state of the mission and your control movements are all that are required to be saved because of the way that *Aces Over Europe* processes its world information.

You might think that just saving control movements must mean that there are only a few things that can occur within a mission since everything is a reaction to those movements. This is certainly not the case. While it is true that in every given instant only a finite number of things can happen, there are so many variables that the laws of probability tell you the variety is infinite. While you might imagine you can replay a mission and perform the exact same control movements at the exact same instants in time and recreate a mission, the probability of recreating the exact movements is far less than being struck by lightning a dozen times in your life—it just simply won't happen.

The size of the tape is relatively small because only the initial state and the control movements are recorded. There is a problem, though, inherent in this approach. Since everything evolves from the initial state in a sequential manner, the entire mission must be saved to tape. You cannot use the Mission Recorder to chop out the first few boring minutes of a mission tape because all you would have left would be a meaningless string of control movements without any attached context. This is a limitation that you must live with.

Using the Mission Recorder

When you select Mission Recorder from the main menu, you see a list of available tapes that you may load. Choose the tape you wish to view or edit and select Load.

Since you can only supply an eight-character name to identify your tape, you might want to make a note of it in your handwritten mission logbook if you are keeping one. That way, you can have easy access to the nature of the mission tapes in your library.

Since the *Aces Over Europe* manual does an excellent job explaining the controls of the Mission Recorder, only additional information will be presented here. For more information, turn to pages 188–192 of your Dynamix manual.

Moving through a Tape

The left side of the Mission Recorder control panel allows you to navigate through your tape. The buttons at the top control tape movement much like a traditional VCR. The most obvious exception, however, is the Rewind button. On the Mission Recorder, the Rewind button returns the tape to the beginning frame.

To move forward in the tape, select either the Play button, the Single-Frame Advance button, or the Fast-forward button. When fast-forwarding, the screen turns black, and a location counter ticks off the increments. Choose the Stop button to stop the tape. The location slider also allows you to move forward through the tape. Simply drag the slider with your mouse to the desired location and release the mouse button. The tape advances and stops automatically.

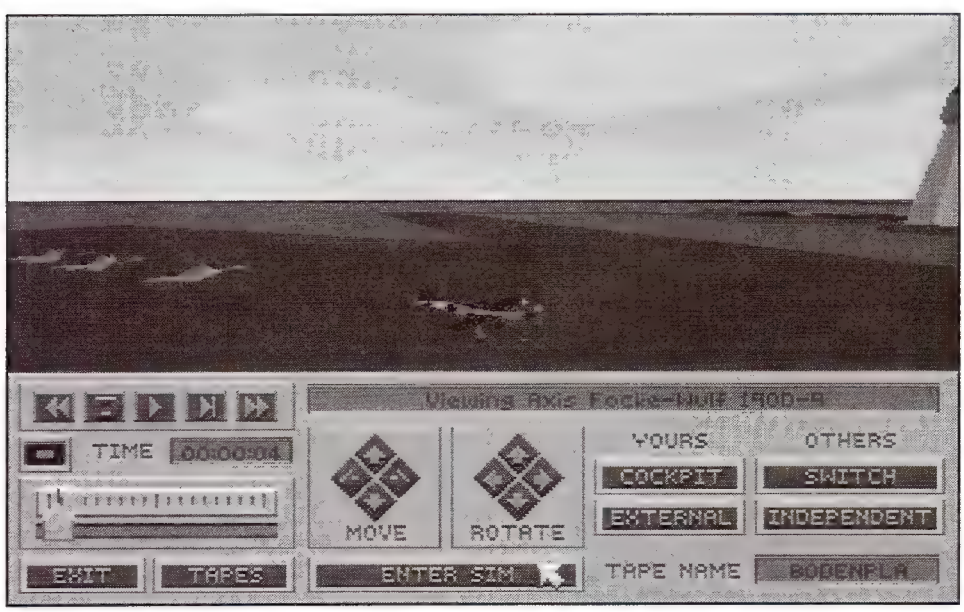


Figure A-1

The Mission Recorder control screen

The time counter always shows the time elapsed since the mission began. The location counter (if displayed when fast-forwarding) indicates the internal counter. This can make advancing to a particular location difficult. If you are sitting down to perform a significant editing session on a tape, you might want to play the tape all the way through and make a note of the time and the location of the slider during the major events of the tape. This will help you as you navigate through your editing session.

You can remove the control panel by tapping Esc. When in the Full Screen view, you start and stop playback by tapping the S key. You can also advance in single-frame increments by tapping the + key on your numeric keypad.

Camera Controls

By using the camera controls on the right side of the panel together with your joystick, you can place the imaginary camera in any location and look in any direction. You can also record camera movements, which allows you to pan and track shots.

All camera changes and movements are recorded as you move through your tape. If you move the camera while the tape is playing, all movements are then recorded. However, you might want to stop the tape and experiment with several different views before selecting one that you like and then starting the tape. In the latter case, only the camera position you finally choose is recorded onto your mission tape.

Cockpit (Internal) View

The Cockpit button sets the view as the Forward Cockpit view. You can change this Internal view by using the function keys or by pressing Control button 2 and moving the joystick when you are in Full Screen view.

External View

The External button places your view in the behind-the-plane External view. You can then select the view by tapping the function keys (F1 through F7). You can use the Alt key to select one of your own custom views (see Chapter 11). The various arrow buttons on the middle of your control panel enable you to zoom and rotate the view. When in Full Screen mode, you can freely rotate the view by holding down Control button 2 and

moving the joystick. You can also zoom in and out using the keyboard commands.

The Switch button allows you to cycle through the other actors in the tapes (the other planes and certain ground targets). An explanation of the subject that you are viewing is displayed in the Text box above the button. This button only works when you are already in the External view, and it places you directly behind the selected actor. The function keys do not work to change the viewing angle (they do return your view back to your own plane), but you can rotate your view using the on-screen buttons or your joystick when you switch to Full Screen mode. If you have changed the viewing angle, the camera location is saved. Cycling again through the actors brings you back to your customized view.

Independent View

Selecting the Independent view does not change your viewing angle immediately, but it does, in a sense, free the camera from any "undue restraints." In this view, the dimmed right-left arrows become active. Now you can move your camera's location and direction freely. The zoom controls now act as movement controls, moving the camera toward or away from an object. By using the Independent view, it is possible to move closer to a plane than you could with the External views and the zoom controls. If you get too close, however, some of the polygons representing the plane (or the ground target) begin to drop out.

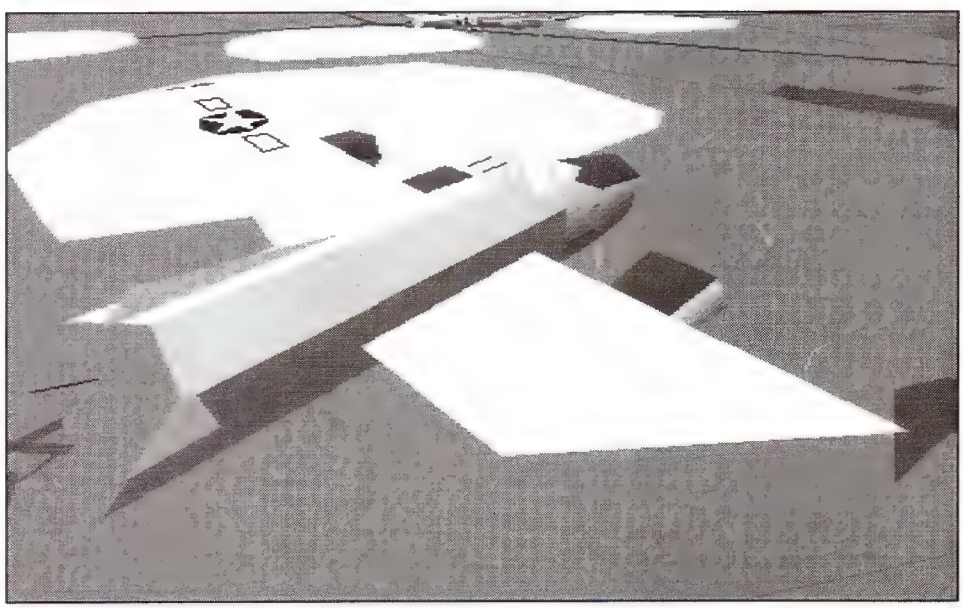


Figure A-2

Camera shot taken too close to a B-17. Notice how the details become chopped off as the camera moves close to the object.

When you switch to the Full Screen view, you can use your joystick to rotate the view and the zoom keys on the keyboard to move closer or further from an object. It is significantly easier to move around in the Independent view by using your joystick and the zoom keys; the control is smoother and more intuitive, allowing you to place your camera more precisely.

Camera Movement

The best time to set up a shot is when the tape is stopped because then you can experiment with your final angle, the one active when you begin to play the tape. This final angle is the one that is saved.

You can also set up a shot, start the tape rolling, and then move the camera. Your movement is then recorded on the tape. It is generally a good idea to keep live camera movement to a single dimension such as a pan or a zoom or a pull-in or pull-out shot (possible with the Independent view selected). When you perform camera movements live, your best results are achieved by using the Full Screen view and moving with the joystick or keyboard. After you set up your shot, tap [S] to start the tape rolling, pan with the joystick (perhaps to follow a plane as it flies overhead), and tap [S] again to stop the tape so you can set up your next shot.

Back in the Saddle

Hop back into the cockpit by selecting the Enter Sim button, which allows you to use the Mission Recorder to set up your own training missions—such as an attack on a flak-protected fortified pillbox, which is not covered in the training missions. You can also jump into the simulation to try to remedy a mistake you made or to achieve some heretofore impossible task. After the mission is completed, you can either view the mission debriefing for your revised flight or return to the Mission Recorder.

Putting Together an Exciting Tape

With a little bit of effort, you can utilize the Mission Recorder to create quite a spectacular film of that special mission where your flying skills really saved the day. Perhaps the most elementary rule of good tapesmanship is just this: keep it simple.

Consider yourself a documentarian who is armed with unlimited footage. It is your task to creatively use the visual images to tell the story of your mission. Telling an effective story means telling a clear and simple story. Throwing in every possible camera angle and complicated pan only breaks up the narrative flow of your tape and makes it disorienting for your audience.

Try to hold shots as long as you can, especially when using the Independent view. A good rule of thumb is to keep your Independent view shots between 5 to 10 seconds in length. Any shorter, and the tape appears discontinuous and confusing. Any longer, and you risk boredom.

Keep your shots moving from connected action to connected action. If your mission includes a dogfight while attempting to bomb an airfield, continuously switching between a plane making a bombing run and a plane engaged in a dogfight only makes the tape lose its dramatic feel. Consider following a single plane as it makes its run, and use different camera angles to tell the story. If other action is going on somewhere else, set up your shot so the other action appears in the background. Then, when you move away after the bomb has been delivered, the thread of continuity is maintained.

Don't forget about the Switch button. Showing the action from a different perspective is very refreshing and offers an alternate point of view. Consider establishing different mission events with a wide-angle shot, preferably one in which the actors approach a stationary camera view. This sets the stage nicely for the more intense close shots that follow.

Perhaps one of the most effective camera views is the External view on the plane that is central to the action that you are trying to convey. By using the Full Screen mode and rotating around your target as the action progresses, you can convey an incredible amount of exciting information.

Don't forget the establishing and trailing shots. You want your film to begin and end significantly, so one technique that works well for an initial shot is to set up an independent camera at ground level far away from the planes on the runway. Start the tape rolling and move in on the plane, stopping before you get too close. While the shot is still live, you can then pan the camera to watch the planes take off and fly into the distance. This takes some practice, but you can always rewind the tape and start again.

Another effective beginning shot is to select External, rotate to an exciting angle, and zoom out completely. Start the tape and begin your zoom in. Since the view is locked to your plane, you cannot overzoom. As your plane takes off, rotate the view to watch whatever you would like. Stop the tape and select Independent, making no adjustment. Start it rolling again to watch your plane fly off screen (or off into the distance if you were set up behind). Consider the same type of shot in reverse for the ending view, letting the planes diminish as they fly off into the distance or prepare to land.

One last suggestion: remember that these are just suggestions. Be creative and experiment, experiment, experiment! You have nothing to lose and a perhaps the great American film to gain.

Screen Captures

At almost any time while in *Aces Over Europe*, you can create a screen capture of the current screen. There are a few exceptions (such as when a video clip is showing) when you cannot perform a capture.

To create a screen capture, hold down either the Alt or Ctrl key while pressing T. Alt - T creates a standard resolutions screen capture (320 × 200 pixels in size) while Ctrl - T creates a 640 × 400 screen capture. The format for the captures that is placed in your *Aces Over Europe* directory is IFF (Interchange

Figure A-3

Dramatic view of an airfield under attack in *Aces Over Europe* using the Independent controls in the Mission Recorder

File Format), denoted by an .LBM extension. A 320 × 200 capture occupies 64K while a 640 × 400 capture takes up 256K.

The captures are named for the type of plane that you are currently flying and are numbered sequentially (i.e., P-510.LBM, P-511.LBM, etc.). The sequential numbering begins each time you begin a new mission in *Aces Over Europe* and writes over any like-named files already on your hard disk.

You can download any number of file conversion programs from the major on-line services if you need a format different than IFF. If you convert your images into the popular .PCX file format, the size of the image file is considerably less than the original file.

Pilots, Planes, and Targets

The object of being a fighter pilot in *Aces Over Europe* is two-fold. First, you must destroy targets ranging from enemy planes to heavily protected infantry bunkers. Second, you must stay alive. The second goal is up to you and requires skill, practice, and a bit of luck. The first goal is also your responsibility, but you are armed with an extra portion of information.

Every target in *Aces Over Europe* has a corresponding point value, and one of the objects of the game is to rack up as many points as possible in a given mission. Generally, the more points you can accumulate, the better the job you have performed. This is not always the case; occasionally, you may be asked to intercept bombers and although you single-handedly sent four down in flames, they still managed to lay their bombs on target. The mission is a failure.

As you discovered in Chapter 11, the points given for a mission are calculated by adding up all of the point values for the targets you have taken, then reducing that number by a factor of your Difficulty level. To figure your score, look over the tables that follow, add up your totals, then multiply that sum by the overall percentage difficulty indicated in Chapter 11.

Mission Success

The obvious goal for each mission is to achieve a successful resolution. That means making sure that bombers get through to drop their gps if you're flying escort or taking out the primary and secondary target installations in an infantry fortification. While you cannot hope to achieve success in every mission, you should keep the mission goal in mind as you fly. That's how a war is won—by connecting together an impossibly long series of successful missions.

The bonus awarded for the successful completion of the mission goals for any particular mission is 50 points. You should note that no points are awarded for kills made by members of your flight (though they can certainly help to achieve a successful resolution), and no points are lost when members of your flight are shot down.

Computer-Controlled Pilots

The vast majority of the planes zipping around the *Aces Over Europe* world are not controlled by you but by virtual pilots. These pilots exist only within the mathematical constructs of the simulation, yet they possess abilities, preferences, and skill levels just like you do. Some might even be able to fly rings around you.

The artificial intelligence (AI) pilots in the simulation, both friendly and enemy, are represented by an assortment of variables including aggressiveness, gunning accuracy, ability to predict the maneuvers of another pilot (meaning you), and predisposition toward certain maneuvers.

The AI pilots are divided into five classes: Novice, Regular, Veteran, Expert, and Ace. The first four are "cookie cutter" personalities. Every rookie pilot, given the same set of circumstances, flies just like every other rookie pilot. The aces are another matter because great care has been taken to model their flight abilities to closely match their real-world namesakes.

The first mysterious connection in the world of AI pilotdom is the pilot–plane connection. As you read in Chapter 6, each type of plane has a distinct advantage and generally a plane has some type of advantage over whatever plane it is facing. AI pilots are rated by their knowledge of the plane that they are flying. Novice pilots tend to treat all planes alike, while expert pilots know how to milk every advantage out of an FW-190A.

Pilots are also ranked by their predisposition toward certain maneuvers. Novice pilots tend to fly conservatively, while expert pilots might favor Immelmanns in certain situations. At any given moment, an AI pilot executes his next choice based on a multitude of constantly changing variables. Having a predisposition for certain maneuvers, he weighs decisions in favor of that maneuver when the circumstances warrant it.

AI pilots are also aware of what is happening around them. In the words of Tucker Hatfield, Dynamix's *Great Warplanes* team quality engineer, "Bullets are God's way of telling you to do something different." If an AI pilot has a plane bearing down on his tail letting a stream of 15-mm shells fly, then the predisposition to certain maneuvers is altered to take into account this very bad situation. The pilot attempts to get away.

The pilots also operate under a self-evaluation timer. At certain times a timer initiates, and if the timer goes off and the state of the pilot's situation hasn't changed (like a Bf-109 is still following too closely), he then takes an action beyond his normal stable of operations.

As an AI pilot readies for attack, he evaluates all of the possible targets in relation to an array of variables: Is one climbing too fast? Is the other banking away beyond my reach? Can I catch that plane in level flight? All the decisions are summed up, and one of the targets presents itself as the most vulnerable. Then the pilot takes action.

There are times when novice AI pilots can show the effects of battle strain or their own inexperience. When you are bearing down on their tail, pelting them with bullets, or consistently outmaneuvering them, they might freeze up (overwhelmed by the situation) and simply fly straight and level.

Aces are expert pilots through and through, but they possess abilities that reach beyond that of the expert class. An AI ace is the only pilot class that can fly beyond the maximum performance level of a plane. Ordinary AI pilots always fly within the safe operational levels of a plane, never diving too steeply or turning too hard and risking a blackout. Aces can and do fly their planes to the maximum and can generally outrun even an expert human pilot because of their uncanny knowledge (they do have the brains of a computer, after all) of their own plane and the plane that you are flying.

Aces are also experts at predicting what maneuver you will perform next. They are always thinking a move ahead, attempting to get a good shot. Because of this, sometimes the only way to beat an ace (especially if you are flying an inferior airplane) is not to fly by the rules. Be unpredictable and nonsensical, and you may find yourself getting into a good firing position.

Aces are scripted within the simulation; each individual has a catalog of favorite maneuvers and tactics that best represent the manner in which the actual pilot flew in the war. This level of modeling adds a true human feel to an ace encounter; you can tell that the pilot is different. Therefore, after you fly against a particular ace a number of times, you can gradually begin to crack his code.

Setting up an ace encounter and flying hard, deliberately utilizing every "stock" maneuver and then saving the mission to tape, gives you a documentary record of how the ace flies and responds.

Study the tape to learn what maneuvers he uses in each particular situation, then enter the simulation and try something different to see what happens. This game of "ace busting" is a true challenge for an experienced pilot. It becomes even more interesting when you give yourself a decidedly inferior plane and then set out to prove your mettle.

Aircraft Point Values

In this appendex are three charts that indicate the maximum point values for shooting down the various planes in *Aces Over*

Table B-1 USAAF Aircraft Point Values

Plane Type	Novice	Regular	Veteran	Expert	Ace
P-51D	50	60	70	80	150
P-38J	40	50	60	70	140
P-47D	40	50	60	70	140
B-26	70	80	90	100	N/A
B-17G	90	100	110	120	N/A
B-24J	90	100	110	120	N/A

Table B-2 RAF Aircraft Point Values

PLANE TYPE	NOVICE	REGULAR	VETERAN	EXPERT	ACE
Typhoon	40	50	60	70	140
Tempest	40	50	60	70	140
Spitfire IX	40	50	60	70	140
Spitfire XIV	50	60	70	80	150
Mosq. XVII	50	60	70	80	N/A
Mosq. VI	50	60	70	80	N/A
B-25	70	80	90	100	N/A

Europe. Notice that the values get decidedly higher the more skill your opponent has. You cannot tell the actual skill rating of a pilot until you blast him from the sky. If you are keeping track of your mission in detail, pause the game (P) when the message flashes on the top of the screen. You will then see the rating of the pilot you just downed.

Vehicle Point Values

In many missions, particularly Close Support and Interdiction missions, you are asked to take out vehicles that are often traveling in a convoy down a paved road. You also fly missions in which you are to destroy a military support train that is often carrying

Table B-3 Luftwaffe Aircraft Point Values

PLANE TYPE	NOVICE	REGULAR	VETERAN	EXPERT	ACE
Bf-109G	30	40	50	60	130
Bf-109K	30	40	50	60	130
FW-190A	50	60	70	80	150
FW-190F	50	60	70	80	150
FW-190D-9	50	60	70	80	150
Me-262	60	70	80	90	160
Ju-88S	60	70	80	90	N/A
Ar-234B	70	80	90	100	N/A

Table B-4 Allied Vehicle Points

VEHICLE	POINTS	SUGGESTED ORDNANCE
Sherman Tank	25	2 rockets
Churchill Tank	25	2 rockets
2½-ton Truck	15	13-mm MG
Jeep	15	13-mm MG
Half-track	25	13-mm MG
DWCK (Duck)	15	13-mm MG

troops, munitions, or tanks on flatcars. The tables in this section provide the point values for the various vehicles you will be asked to destroy, along with suggested ordnance needed to take them out of commission. Often the ordnance that you are carrying does not match that in the chart (you may be carrying bombs instead of rockets, for example). If you are carrying more powerful ordnance, you can always destroy the target.

Table B-5 German Vehicle Points

VEHICLE	POINTS	SUGGESTED ORDNANCE
Panzer IV	20	2 rockets
Jagdpanzer IV	20	2 rockets
Panther Tank	25	2 rockets
Tiger Tank	30	2 rockets
Flak Tank	20	20-mm cannon
Half-track	20	20-mm cannon
Puma AC	20	20-mm cannon
Truck	15	.50-cal MG

Table B-6 Locomotive Points

VEHICLE	POINTS	SUGGESTED ORDNANCE
Locomotive	60	.50-cal (15-mm) MG
Boxcar, Grey	20	.50-cal (15-mm) MG
Boxcar, Brown	20	.50-cal (15-mm) MG
Boxcar, Green	20	.50-cal (15-mm) MG
Flatcar w/Tank	20	.50-cal (15-mm) MG

Ship Point Values

You face a number of ships both in open water and docked at harbor facilities when performing antishipping strikes. Some ships may be damaged or sunk, and you earn points for both actions. It is not always necessary to sink a ship to achieve the mission objectives. If you are going up against an Allied Pennsylvania-class battleship, be aware that within the game that ship is impossible to sink with a single plane's bomb load.

Table B-7 Allied Ship Point Values

SHIP	POINTS FOR SINKING	POINTS FOR DAMAGE	SUGGESTED ORDNANCE
Pennsylvania Class	100 *	75	bomb
Northampton Class	75	—	bomb
Fletcher Class	50	—	bomb
LCM, Landing Craft	25	25	bomb
LST, Landing Craft	50	—	bomb
LCI, Landing Craft	25	25	bomb
Freighter	50	—	bomb
Tanker	50	—	bomb

*See text above

Table B-8 German Ship Point Values

SHIP	POINTS FOR SINKING	POINTS FOR DAMAGE	SUGGESTED ORDNANCE
Z-Class Destroyer	50	—	bomb
E-Boat Torpedo Boat	25	—	20-mm cannon
Tanker	75	25	bomb
Freighter	100	—	bomb

Ground Targets

When assigned to attack a ground target, be sure to check your recon photo (accessed from the Flight Map) to determine the primary and secondary target goals. If you take out only the primary targets, your mission is considered a success. At times, though, you may find the best strategy (when you have clear skies above) to take out the targets that deliver defensive fire. You may then focus your attention on the larger targets without being bothered by flak or machine-gun fire. Don't remain around the target site too long, though, because enemy fighters are sure to approach if one word of your attack gets out.

Due to an inadvertent bug that crept into the release version of Aces Over Europe, *German flak towers have been rendered indestructible. Do not waste your time or your ordnance attempting to take one out.*

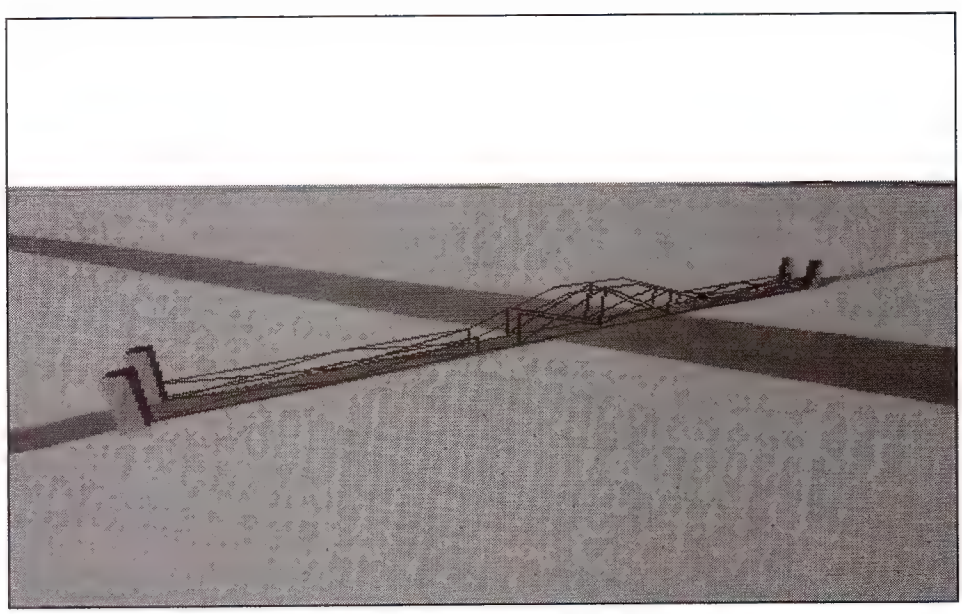


Figure B-1

A long-span road bridge

Table B-9 Bridge Targets

Target	Points	Suggested Ordnance
Road Bridge, Short Span	100	bomb
Road Bridge, Long Span	150	bomb
Railroad Bridge, Short Span	120	bomb

Table B-10 Airfield Targets

Target	Points Each	Number at Facility	Suggested Ordnance
Grass Airfield—160 Possible Points			
Small Hangar	40	3	2 rockets (1 salvo)
Base HQ	26	1	.50-cal (15-mm) MG
Quonset Hut	2	2	.50-cal (15-mm) MG
Fuel Tank	5	2	.30-cal (13-mm) MG
Concrete Airfield—210 Possible Points			
Small Hangar	50	2	2 rockets
Base HQ	16	1	.50-cal (15-mm) MG
Quonset Hut	2	2	.50-cal (15-mm) MG
Fuel Tank	10	3	.30-cal (13-mm) MG
Repair Facility	30	2	2 rockets
Flak Tower	?	2	?
AA Emplacement	0	1	.50-cal (15-mm) MG

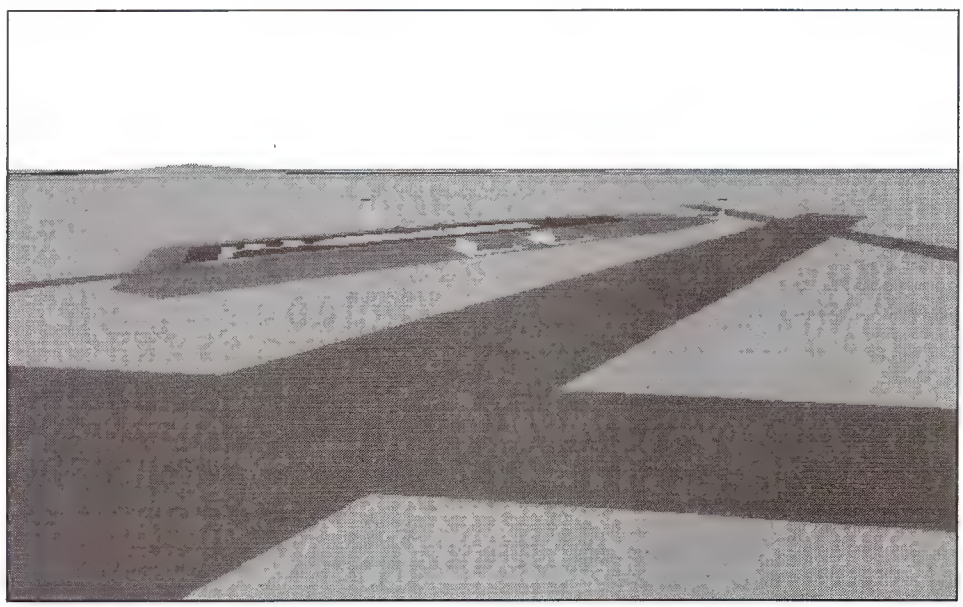


Figure B-2

German concrete airfield

Table B-11 Fortified Infantry Position Targets (96 Possible Points)

TARGET	POINTS EACH	NUMBER AT FACILITY	SUGGESTED ORDNANCE
Pillbox	15	4	2 rockets
Gun Emplacement	6	6	.50-cal MG

Table B-12 Coastal Battery Targets (140 Possible Points)

TARGET	POINTS EACH	NUMBER AT FACILITY	SUGGESTED ORDNANCE
Coastal Artillery Batt.	90	1	2 rockets
Bunker	30	1	2 rockets
AA Emplacement	5	4	.50-cal MG

Table B-13 Harbor Facility Targets (387 Possible Points)

TARGET	POINTS EACH	NUMBER AT FACILITY	SUGGESTED ORDNANCE
Large Warehouse	70	1	2 rockets
Warehouse	7	7	2 rockets
Oil Storage Tank	120	2	2 rockets
Fuel Tank	3	4	.30-cal MG
Quonset Hut	3	2	.50-cal MG
HQ Building	10	1	.50-cal MG
Crane	0	1	2 rockets

Figure B-3

German infantry position

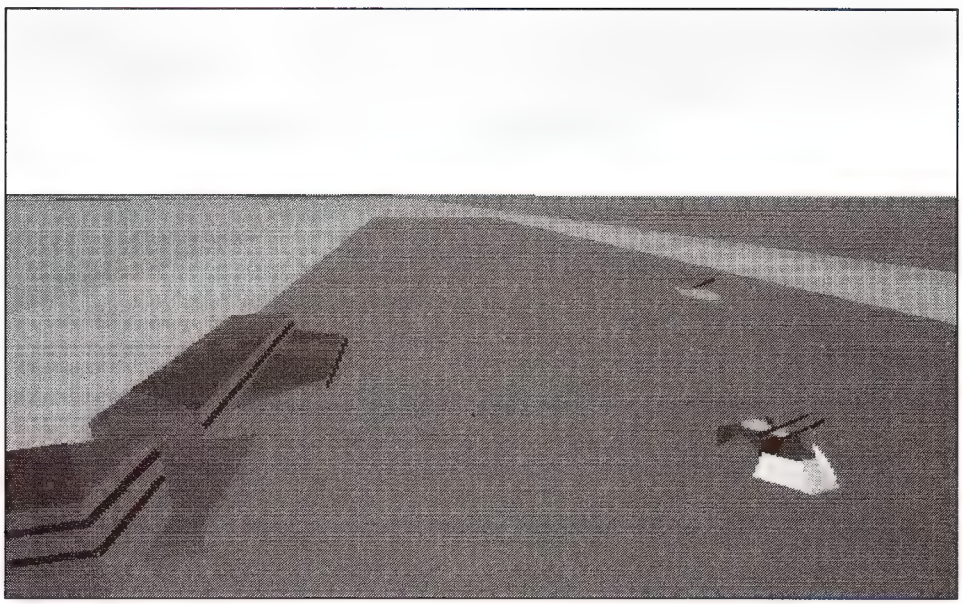


Figure B-4

German coastal battery

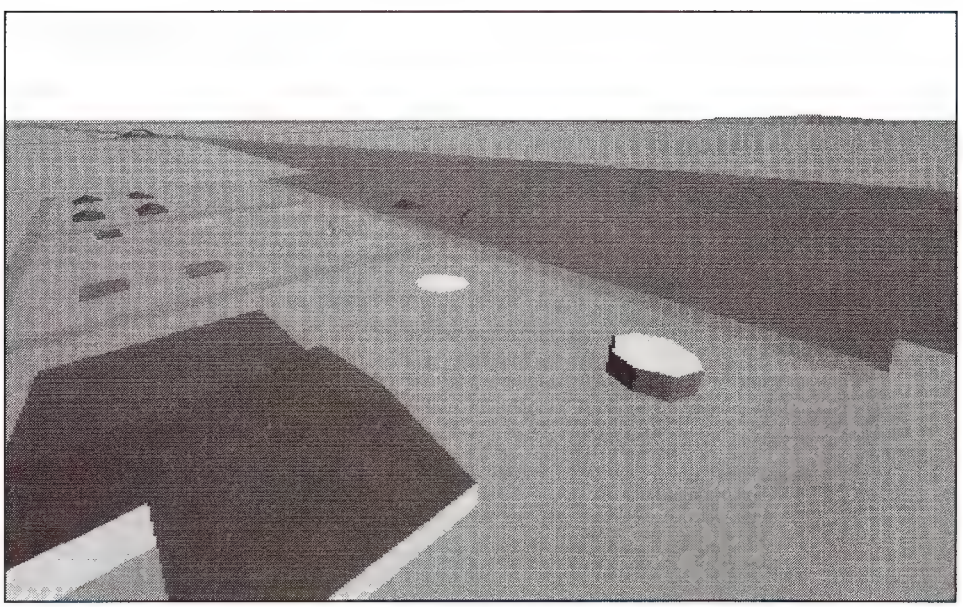


Figure B-5

German harbor facility

Table B-14 Crossbow V-1 Site Targets

TARGET	POINTS EACH	NUMBER AT FACILITY	SUGGESTED ORDNANCE
V-1 Radar Site—330 Possible Points			
HQ Building	60	1	20-mm cannon
Bunker	70	1	2 rockets
Radar Tower	100	2	2 rockets
V-1 Launch Site—310 Possible Points			
HQ Building	80	1	20-mm cannon
Launch Ramp	200	1	2 rockets
AA Emplacement	10	3	.50-cal MG

Table B-15 Supply Depot Targets (190 Possible Points)

TARGET	POINTS EACH	NUMBER AT FACILITY	SUGGESTED ORDNANCE
Large Warehouse	40	2	2 rockets
Warehouse	8	4	2 rockets
HQ	5	1	.50-cal MG
Quonset Hut	1	3	.50-cal MG
Fuel Tank	10	7	.30-cal MG

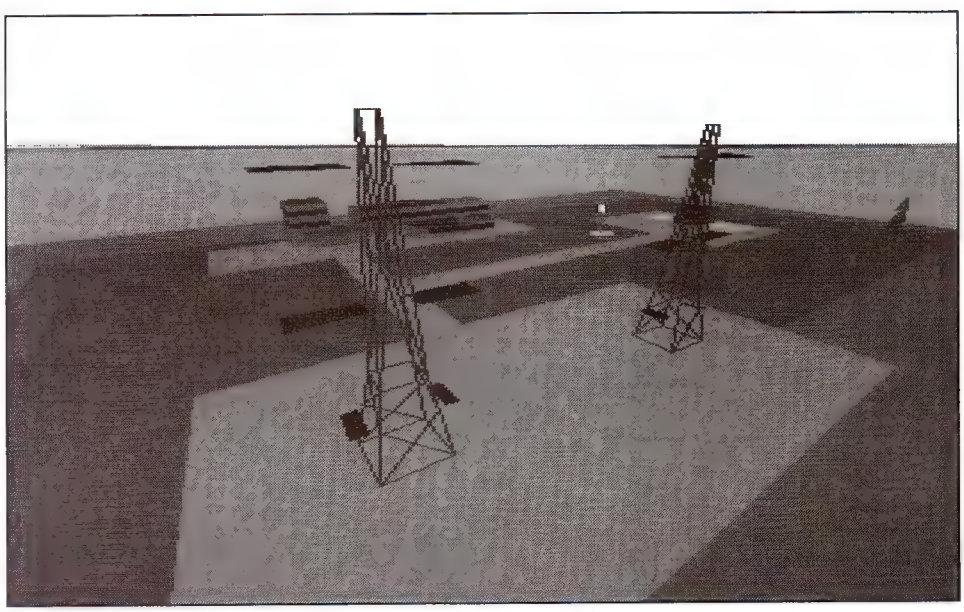


Figure B-6

V-1 radar site

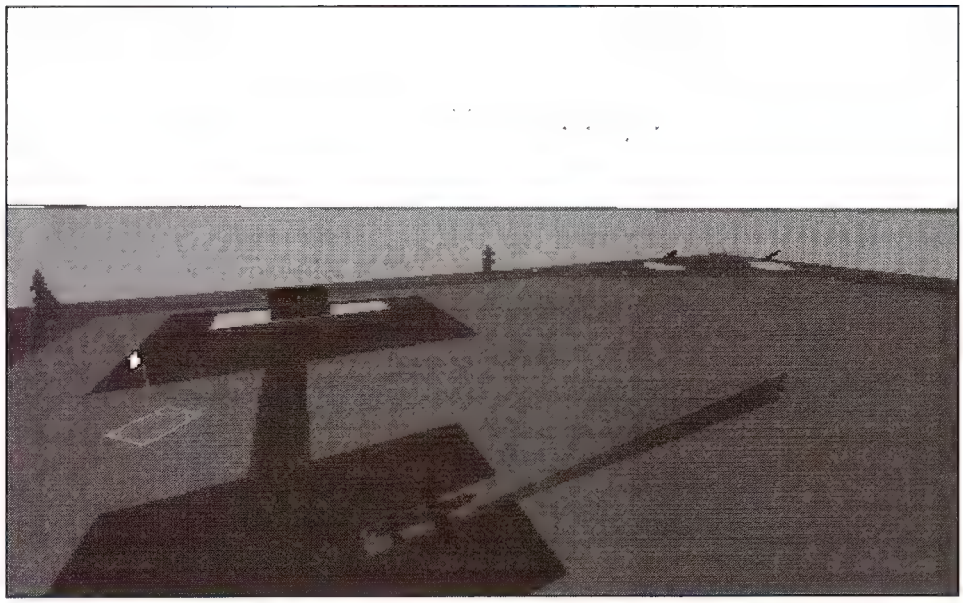


Figure B-7

V-1 rocket launchpad

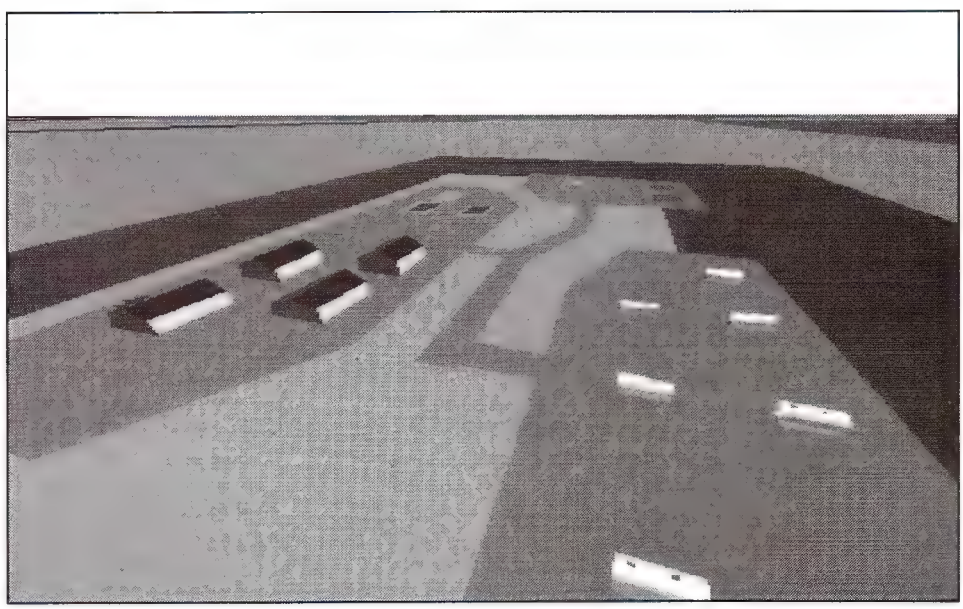
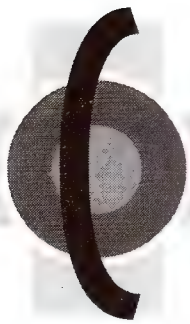


Figure B-8

Allied supply depot



The SQUAD0.DAT File

Aces Over Europe contains many data files that change as you work through various missions in the simulation and as you pursue many fine and illustrious fighter-pilot careers. By searching through the files in Library 7 of CompuServe's Flight Simulation forum, you can track down most of the information you would ever want to know about the various data structures used within the game.

This chapter is an overview of the SQUAD0.DAT file, which contains information regarding each of the squadrons active within the world of the simulation. By working with a hex debugger such as DOS's DEBUG command, you can tweak some of the variables—changing the types of planes within a certain squad, for example.

By investing some time, you can effectively throw a wrench into the entire historical fabric of the simulation and do battle against only Luftwaffe Me-262s, for example. By studying the file, get a feel of the historical depth of the simulation and how squadrons evolved and changed over time. A clever programmer can extract the information within the file to create an accurate historical accounting of any of the flying units within the simulation.

It should be noted that tinkering around with the SQUAD0.DAT file is not recommended by Dynamix. While

the information presented is believed to be as accurate as possible, Dynamix reserves the right to alter its data structures at any time. Obviously, if you decide to go spelunking within the SQUAD0.DAT file, make a copy of the original file first so that you may restore the historical integrity of the simulation. This information was provided by James W. Johnson, one of the chief beta testers of *Aces Over Europe*, who spent countless hours under the hood and in the cockpit.

The File Itself

The SQUAD0.DAT file holds all of the relevant information pertaining to each and every aircraft unit represented in *Aces Over Europe*. This includes bomber units (which are all AI units), as well as the various squadrons with which you may fly. Each flight unit is described by a variable-length record that conforms to a fixed data format. To modify a particular unit, you must first locate the record within the SQUAD0.DAT file and then work with the bytes within that particular record.

The information contained in each unit's record includes the following data:

- Dates of the unit's history (creation, disbandment, leaves from the front, etc.)
- Aircraft type assigned to the unit
- Bases where unit is stationed
- Number of aircraft assigned to a flight
- Flight formation
- Mission types

Table C-1 Unit Record Structure within the SQUAD0.DAT File

BYTES	CONTENTS
01–02	Offset address for text relating to this unit
03	Service Nationality 00 = USAAF 01 = RAF 02 = Luftwaffe
04	Unit Type 00 = Fighter 01 = Light Bomber (Ar-234 and Mosquito Units) 02 = Medium Bomber (Ju-88S, B-25D [RAF], and B-26 Units) 03 = Heavy Bomber (B-17G and B-24J Units)
05	Unit Pilot Quality: 00 = Poor 01 = Fair 02 = Average 03 = Good 04 = Excellent
06–07	Number (N1) of 4-byte subrecords that follow immediately, describing the unit history. The format of the subrecords is as follows: M1 = Month 00 = Jan, 01 = Feb, …, 0B = Dec D2 = Day 01, 02, …, 1D, 1E, 1F(31) Y3 = Year 2C = 1944; 2D = 1945 S4 - Unit status beginning on the preceding date 00 = Active 01 = Away from the front (on leave, refitting, etc.) 02 = Disbanded 03 = Evacuated 04 = Removed from game
08–11	1st unit history subrecord (SR) desribed above
12–15	2nd unit history SR
xx–xx+1	N1st unit history SR

Table C-1 Unit Record Structure within the SQUADO.DAT File (continued)

BYTES	CONTENTS
xx+2–xx+3	Number (N2) of 5-byte subrecords that describe this unit's aircraft assignments. The first 3 of these 5 bytes are the date of assignment and follow the same format as the unit history dates described above. The 4th and 5th bytes are the hex code of the aircraft assigned to this unit. These aircraft codes are: 00 00 = Bf-190G 01 00 = Bf-190K 02 00 = Fw-190A 03 00 = Fw-190F 04 00 = Fw-190D 05 00 = Ju-88S * 06 00 = Me-262 07 00 = Arado-234B 08 00 = Hawker Typhoon 09 00 = Hawker Tempest 0A 00 = Spitfire Mk IX 0B 00 = Spitfire Mk 14 0C 00 = Mosquito Mk 18 0D 00 = Mosquito Mk VI 0E 00 = P-51D 0F 00 = P-38J 10 00 = P-47D 11 00 = B-26 * 12 00 = B-25D * 13 00 = B-17G * 14 00 = B-24J *

*AI–only aircraft

Table C-1 Unit Record Structure within the SQUAD0.DAT File (continued)

BYTES	CONTENTS
xx+4–xx+8	1st aircraft assignment SR
yy–yy+1	N2nd aircraft assignment SR
yy+2–yy+3	Number (N3) of 5-byte subrecords that describe the number of aircraft in a flight for this unit. The first 3 bytes are the date as described above, and the 4th and 5th bytes give the number of aircraft in the flight, beginning on the date given in this SR.
yy+4–yy+8	1st "Number in flight" SR
zz–zz+4	N3rd "Number in flight" SR
zz+5–zz+6	Number (N4) of Basic Flight Formation (BFF) subrecords for unit. Each BFF is 5 bytes long; the first 3 bytes are the beginning date for the formation and the 4th and 5th bytes are the formation hex code number: 01 00 = Vic 02 00 = Line Astern 03 00 = Line Abreast 04 00 = Echelon Left 05 00 = Echelon Right 06 00 = Finger Four (most common formation for Allies) 07 00 = Element (2 aircraft) 08 00 = Rotte, LW (1–2 aircraft) 09 00 = Schwarm, LW (1–4 aircraft) 0A 00 = Kette, LW (3 aircraft) 0B 00 = Bomber Vee (RAF and Luftwaffe) 0C 00 = Heavy Bomber Combat Box (U.S. and RAF) 0D 00 = Medium Bomber Combat Box (U.S. only)
zz+4–zz+8	1st Unit Formation SR
zz+9–zz+13	2nd Unit Formation SR
ww–ww+4	N4th Unit Formation SR
ww+5–ww+6	Number (N5) of Airfield Assignment (AFA) subrecords to follow. Each of these AFA SRs are 5 bytes long with the first 3 bytes giving the date of assignment to the airfield designated and the last 2 bytes being the hex code for the airfield to which the unit is assigned. For hex codes identifying the various airfields, see Table C-2.
ww+7–ww+11	1st Unit AFA SR
ww+12–ww+16	2nd Unit AFA SR
vv–vv+4	N5th Unit AFA SR

Table C-1 Unit Record Structure within the SQUAD0.DAT File (continued)

BYTES	CONTENTS
vv+5–vv+6	Number (N6) of Mission Assignment (MA) SRs to follow. For AI bomber units, the value of these two bytes is always 00 00. Each Mission Assignment SR is 8 bytes in length. The structure of the MA SR is given below:

Bytes	Contents
01–03	Date in the format described above
04	Number of times that this mission type is scheduled to be performed following the date above and until the next date
05–06	Mission Type hex code

Value	Mission type
00 00	Antiship
02 00	Escort bombers
03 00	U.S. Bomber Offensive
04 00	Close Support or Interdiction, Allied
05 00	Close Support or Interdiction, Allied
06 00	Close Support or Interdiction, Allied
07 00	U.S. 8th Air Force
08 00	U.S. 9th Air Force
09 00	Crossbow
0A 00	Crossbow
0B 00	Interdiction
0C 00	Armed Recon
0D 00	Luftwaffe in France
0E 00	Luftwaffe in France
0F 00	Luftwaffe in France
10 00	Luftwaffe Intercept
11 00	Luftwaffe Close Support
12 00	Arado 234B
13 00	All
14 00	Fighter Sweep

07–08	Mission generation seed number (00 00 = Historical mission)

Table C-2 Airfields of Aces Over Europe

Code	Airfield	Code	Airfield
00	Achmer Airdrome	26	Eindhoven Airfield
01	Altenstadt Airdrome	27	Evere Airbase
02	Amiens–Glissy Airfield	28	Fairway Common Airbase
03	Andover Airbase	29	Fassberg Airdrome
04	Asch Airfield	2A	Fels–Am–Wagram Airdrome
05	Banff Airbase	2B	Florennes Airfield
06	Beauvais Airfield	2C	Ford Airbase
07	Bodney Airbase	2D	Friston Airbase
08	Bolt Head Airbase	2E	Funtington Airbase
09	Bonn–Hangelar	2F	Gael Airbase
0A	Boreham Airbase	30	Gahro Airdrome
0B	Bottisham Airbase	31	Gielbelstadt Airdrome
0C	Boxted Airbase	32	Gilze–Rijen Airfield
0D	Brandenburg–Briest Airdrome	33	Glatton Airbase
0E	Bricy Airfield	34	Godelmesnil Airfield
0F	Cambrai Airfield	35	Grave Airfield
10	Carpiquet Airfield	36	Greifswald Airdrome
11	Castle Camps Airbase	37	Greven Airdrome
12	Celle Airdrome	38	Grimbergen Airdrome
13	Chartres Airfield	39	Guyancourt Airdrome
14	Chateaudun Airfield	3A	Kluis Airfield
15	Chievres Airdrome	3B	Halesworth Airbase
16	Cologne Airdrome	3C	Harrowbeer Airbase
17	Coltishall Airbase	3D	Hartford Bridge Airbase
18	Coolham Airbase	3E	Hawkinge Airbase
19	Cormeilles–En–Vexin Airdromes	3F	Holmsley South Airbase
1A	Coulombs Airfield	40	Horham Airbase
1B	Creil Airdrome	41	Hurn Airbase
1C	Creton Airfield	42	Hustedt Airdrome
1D	Culmhead Airbase	43	Hutton–Cranswick Airbase
1E	Darmstadt–Greishem Airdrome	44	Kaltenkirchen Airdrome
1F	Debden Airbase	45	Kirchhellen Airdrome
20	Detling Airbase	46	Langenhagen Airfield
21	Diest Airfield	47	Lasham Airbase
22	Douai Airfield	48	Lashenden Airbase
23	Dreux Airfield	49	Laval Airdrome
24	Dunsfold Airbase	4A	La Vielle Airfield

Table C-2 Airfields of Aces Over Europe (continued)

CODE	AIRFIELD	CODE	AIRFIELD
4B	Le Bouget Airdrome	70	Rechlin Airdrome
4C	Lechfeld Airdrome	71	Reinsehlen Airdrome
4D	Le Mans Airdrome	72	Rheims Airdrome
4E	Leutewitz Airdrome	73	Rheine Airdrome
4F	Lingevres Airfield	74	Rivenhall Airbase
50	Llanbedr Airbase	75	Rosieres Airfield
51	Lobnitz Airdrome	76	Roye–Amy Airfield
52	Longues Airfield	77	St. Croix–Sur–Mer
53	Lubeck Airdrome	78	St. Dizier Airdrome
54	Luneberg Airdrome	79	Sachau Airdrome
55	Lympne Airdrome	7A	Salon Airdrome
56	Maldeghem Airfield	7B	Selsey Airbase
57	Malmsheim Airdrome	7C	Semalle Airdrome
58	Manston Airbase	7D	Skaebrae Airfield
59	Martragny Airfield	7E	Stormede Airdrome
5A	Matlask Airbase	7F	Swanton–Morely Airbase
5B	Melsbroek Airbase	80	Tangmere Airbase
5C	Merville Airfield	81	Thorney Island Airbase
5D	Mons–En–Chausses Airdrome	82	Thorpe Abbots Airbase
5E	Mont De Marson Airfield	83	Tibenham Airbase
5F	Morainville Airfield	84	Tutow Airdrome
60	Meunchen–Gladbach Airdrome	85	Twente Airdrome
61	Munich–Riem Airdrome	86	Uetersen Airdrome
62	Munster–Handorf Airdrome	87	Ursel Airdrome
63	Nancy–Essay Airdrome	88	Varrelbusch Airfield
64	Nurenberg Airdrome	89	Venlo Airfield
65	Neuhausen–Ob–Ek Airdrome	8A	Vertu Airfield
66	Newchurch Airbase	8B	Vitry–EnArtois Airfield
67	Nordhorn Airdrome	8C	Volkel Airfield
68	Oldenburg Airdrome	8D	Warmwell Airbase
69	Ophoven Airfield	8E	Westhampnett Airbase
6A	Paderborn Airdrome	8F	West Malling
6B	Peronne Airfield	90	Woodhaven Airbase
6C	Plantlunn Airdrome	91	Wormingford Airbase
6D	Portreath Airbase	92	Wunstorf Airdrome
6E	Quackenbruck Airfield	93	Neufchateau Airdrome
6F	Rackheath Airdrome	94	St. Dennis Airdrome

Finding a Unit Record

Since the unit records within the SQUAD0.DAT file contain varying amounts of information, their length is not fixed and sorting through the data can be an exercise in madness. Table C-3 provides the addresses for the first byte of all the nonAI combat units. Utilizing the address, you can then locate the record corresponding to the desired unit.

Table C-3 Squadron Addresses within the SQUAD0.DAT File

UNIT	STARTING ADDRESS (DEBUG/NORMAL)	UNIT	STARTING ADDRESS (DEBUG/NORMAL)
356th FS/354th FG	0106/0006	164 Sqdn.	0fE9/0EE9
338th FS/55th FG	01CC/00CC	486 Sdqn.	10DE/0fDE
343rd FS/55th FG	024E/014E	305 Sqdn.	1185/1085
487th FG/352nd FG	02E8/01E8	333 Sqdn.	1214/1114
328th FG/352nd FG	038A/028A	613 Sqdn.	128E/118E
334th FS/4th FG	044C/034C	II/JG 1	13DE/12DE
336th FS/4th FG	04E1/03E1	III/JG 2	14AB/13AB
62nd FS/56th FG	058E/048E	I/JG 4	1599/1499
61st FS/56th FG	0630/0530	III/JG 7	1618/1518
401st FS/370th FG	06EA/05EA	II/JG 11	16bA/15bA
374th FS/361st FG	0783/0683	II/JG 26	1767/1667
602 Sqdn.	0982/0882	III/JG 26	186B/176B
41 Sqdn.	0A05/0905	I/JG 27	198B/188B
132 Sqdn.	0AC3/09C3	III/JG 54	1A81/1981
248 Sqdn.	0B83/0A83	III/SG 4	1B59/1A59
349 Sqdn.	0C04/0B04	Kom. Nowotny	1C3E/1B3E
274 Sqdn.	0CC5/0BC5	JV 44	1C99/1B99
610 Sqdn.	0D76/0C76	III/KG 76	1Cff/1Bff
443 Sqdn.	0E1E/0D1E	III/KG 54	1D72/1C72
181 Sqdn.	0F0F/0E0F	II/KG 77	1DE5/1CE5

An Example

Working through the streams of numbers within the SQUAD0.DAT file can be somewhat daunting, but just remember that the information follows a fixed format. If you get lost in a sea of numbers, track down a value you are sure of and work from there.

It helps to print out a hex dump of the file area in which you are interested. Use a highlighter to select the record that you want to study or adjust—it will make it easier on your eyes.

The remainder of this appendix illustrates a partial dump of a squadron record to give you an idea of how the data is presented.

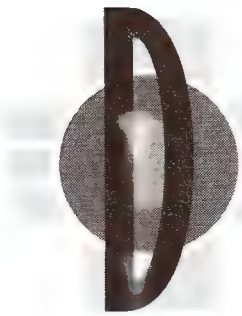
356th Fighter Squadron record within the SQUAD0.DAT file:

```
0100      3F 05 00 00
0100      34 00      <— Number of records in the file
                     (52; 51 Unit records and 1 text record)

356th FS/354th FG

0100      00 00      <— Text Offset for this unit in the text
0100         00         <— Nationality
0100            00         <— Unit type
0100               04         <— Pilot Quality
0100                  02 00      <— # SR, Unit
                                    History
0100                     03 01 2C <— 1 Apr 44,
                                       Active
0110      00
0110      04 07 2D 02    <— 7 May 45, Disbanded
0110         03 00       <—  # SR, A/C type
0110            03-01 2C 0E 00      <— 1 Apr 44, P-51D
0110               0B 02 2C 10      <— 2 Dec 44, P-47D
0120      00
0120      00 0F 2D 0E 00      <— 15 Jan 45, P-51D
0120         01 00       <— #SR, number of A/C assigned to
                            a flight
0120            -03 01 2C 04 00     <— 1 Apr 44, 4 A/C
0120               01 00            <— # SR, Formation
0120                  03    <— 1 Apr 44, Finger 4
```

```
0130    01 2C 06 00
0130        04 00       <— # SR, Bases
0130            03 012C 48 00       <— 1 Apr 44,
                                       Lashenden
0130                05 11 2C 77 00      <— 17 Jun 44,
                                           St. Croix
0140    08 15 2C 02 00      <— 21 Sept 44, Amiens–
                               Glissy–Sur–Mer
0140        0A 19 2C-75 00      <— 25 Nov 45, Rosieres
0140            10 00       <— # SR, Mission type
                               assignments
```



Control Options

Aces Over Europe supports a wide variety of control options, from keyboard-only flight to full stick/throttle/rudder control. As mentioned in Chapter 11, using the best joystick system you can afford will most certainly enhance your flying experience. In this appendix you will find an overview of two advanced flight control systems as well as a few remarks concerning the game port on your computer.

Occasionally you might find yourself having some difficulty with your joystick when you enter a mission. First try recalibrating your joystick from within the cockpit (even if you calibrated it from the Other Options menu beforehand) by tapping F10. You should also recalibrate your joystick every week or so since most joysticks experience drift, making their accuracy wander through repeated use.

Joystick Ports

There are three places to find a joystick port: standard with your computer, on your soundboard, and on a dedicated controller card. While in most cases any joystick port will work fine, you may occasionally experience some problems.

The two most common problems are addressing conflict and speed conflicts. If you have quite a number of expansion boards loaded into your computer, you may have an addressing problem.

Your joystick and some other function may share the same expansion address. (The most common problem is a conflict between multifunction card [standard on many computers] and your sound card.) This makes your computer look two places instead of one when trying to access your joystick input. Generally you can eliminate this problem by disabling one or the other joystick ports. Refer to your owner's documentation for instructions on disabling a joystick port.

You may also experience splotchy performance when you are using a joystick on a very fast computer. This most commonly occurs when using the joystick port on many sounds cards. The computer "overshoots" accessing the joystick at times, so the input stream is not smoothly accepted. You may solve this problem by installing a dedicated joystick controller card. The card will sense the speed of your computer and provide joystick input that matches the speed. Both ThrustMaster and CH Products manufacture excellent, low-cost controller cards.

CH FlightStick Pro

The CH FlightStick Pro is an excellent, high-quality controller that has the proper feel and heft of an actual plane controller. You can select this joystick from the Preferences panel, but you

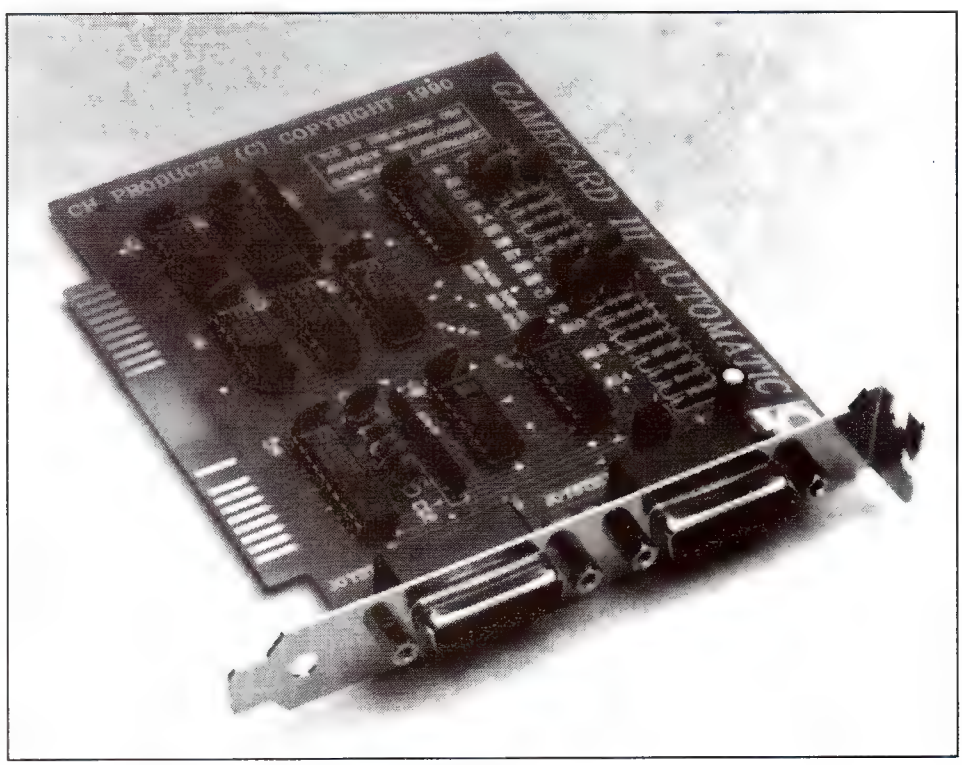


Photo D-1

The CH Gamecard

Photo D-2

The CH FlightStick Pro

can only calibrate the throttle slider from within the simulation by pressing F10.

The controls are as follows:

- **Button 1 (trigger)** Fires selected guns
- **Button 2** Switches view from External to Cockpit and back
- **Button 3** Releases bombs (you will still need the keyboard command for rockets)
- **Button 4** Cycles through the gun selection options
- **Hat (minijoystick)** Allows you to change your Cockpit views; in External view, rotates the free-floating camera around your plane
- **Slider** Throttle control with forward being maximum throttle

The FlightStick Pro features easy-to-reach trim adjustment wheels. Be sure to move these adjustments to their neutral position before you calibrate the joystick.

ThrustMaster Controls

ThrustMaster offers an entire range of control products, each of excellent quality and geared toward providing the most realistic

Photo D-3

ThrustMaster's Flight Control system

flying experience possible. Using their stick, throttle, and rudder pedals together will allow you to fly HOTAS (Hands On Throttle And Stick), minimizing any reliance on the keyboard and thereby creating a more accurate illusion of true flight control.

Flight Control System

The Flight Control System is a joystick molded to accurately represent an aircraft flight stick (more akin to a jet flight stick than a WWII stick). While not as hefty as the FlightStick Pro, it is an excellent, high-quality controller.

The layout of the controls is as follows:

- **Button 1 (trigger)** Fires selected guns
- **Button 2 (thumb)** Switches view from external to cockpit and back
- **Button 3 (midstick)** Releases bombs (you will still need the keyboard command for rockets
- **Button 4 (pinkie)** Cycles through the gun-selection options hat: moving this mini-joystick will allow you to change your in-the-cockpit views, also, when in external view, you can use the hat to rotate the free floating camera around your plane.

Weapons Control System Mark I

The Weapons Control System Mark I is a separate controller that functions primarily as a throttle control for the left hand. On the surface of the control, six buttons and one three-position switch allow you to control a great variety of the tasks within the *Aces Over Europe* cockpit.

The throttle control is straightforward: push forward for more power, back to ease off. You will feel two detents as you push the throttle forward. The first is full throttle and the second, all the way forward, is maximum emergency throttle.

Be sure to select the controller from the Preferences screen. To properly configure your WCS to work with *Aces Over Europe*, you must set the 1, 2, and 5 dip switches to the On position.

You need not have the ThrustMaster joystick to use the WCS. Since it simulates keyboard-based commands, it will work with nearly any joystick.

The controls of the WCS Mark I are as follows:

- **Button 1** Send radio message
- **Button 2** Unjam guns

Photo D-4

ThrustMaster's WCS Mark II

- **Button 3** Engage autopilot
- **Button 4** View map
- **Button 5** Drop external fuel tank
- **Button 6** Dive brakes (if available)
- **Toggle 7A** Cycles through flap positions
- **Toggle 7B** No function
- **Toggle 7C** Raises or lowers landing gear

Weapons Control System Mark II

The most recent version of the ThrustMaster WCS is the Mark II, which is a much more versatile system than the Mark I. It allows full customization of all the controller buttons (as well as some on the Flight Control System). To utilize the Mark II, you must first download the appropriate control program to the controller before starting up your *Aces Over Europe* session. See the Mark II manual for instructions on downloading programs.

To fully utilize the Mark II, you should select Keyboard for the throttle control from the Preferences screen. If you are planning to use a Flight Control System with your Mark II, select Joystick 1 from the Preferences menu because the Mark II generates the signals for Buttons 2 through 4 and the hat.

The following is an example of a Mark II program that sets up the controller for *Aces Over Europe* and utilizes the same functions as the Mark I above. Refer to the Mark II manual for instructions on customizing this program (for example, you may wish to program a button to fire a salvo of rockets). You should leave the throttle control instructions as is, however.

```
FCS
GAME 2
BTN UB ENTR     Internal/external view
BTN MB BSP Bomb release
BTN LB G   Weapons select
BTN HU F5 F5    Up-forward view
BTN HR F4  Right view
BTN HD F2 F2    Rear view
BTN HL F3  Left view
BTN HM F1  Forward view
WCS
BTN 1 S     Send radio message
BTN 2 U     Unjam guns
BTN 3 A     Auto pilot
```

```
BTN 4 M    View map
BTN 5 D    Drop tanks
BTN 6 B    Dive brakes
RKR UP F   Flaps
RKR MD '   No-op
RKR DN L   Landing gear up/down
THR 10 1 1 2 3 4 5 6 7 8 9 0 = = = = =
Type 2 throttle
```

Rudder Pedals

ThrustMaster rudder pedals allow you to control your plane's rudder with your feet in the same manner pilots control rudders. The pedals plug into your joystick port, and then you fasten your joystick plug to the pass-through rudder adapter. To use the pedals, select Rudder Pedals from the Preferences screen. When calibrating the control, you will be asked to press the controller button; use Button 1 on your joystick.

Perhaps the only problem with the rudder pedals is that they tend to slip around on the floor in the heat of battle. If you are using them on a wood floor, buy a piece of no-slip rug padding at your local home improvement store and place it under the rudder pedals. For carpeting, try placing a brace—perhaps a 2×4—at the back of the controls. You can anchor the board across the legs of your desk.

Flying with rudder pedals truly turns the reality of the experience up several notches. You will find yourself performing slips and tighter turns intuitively. Unfortunately, it's easy to forget about the rudder when you are forced to use the keyboard.

Bibliography

Ball, Albert. *The Fighters.* London: Aero Books, 1984

Basham, Tom; Ciciora, Bill; and Pearson, Eric. *Dynamix Great War Planes: The Ultimate Strategy Guide.* Rocklin: Prima, 1993.

Bishop, Edward. *Their Finest Hour.* New York: Ballentine, 1968.

Brown, Ashley; and Reed, Jonathan; eds. *The Air Fighters.* Harrisburg: National Historical Society, 1988.

Brown, Dale, ed., *The Luftwaffe.* Alexandria: Time-Life, 1982.

Craven, Wesley; Cate, Frank; and Lea, James. *The Army Air Forces in World War I.* vols. 1–6. Washington: Office of Air Force History, 1983.

Deighton, Len. *Fighter: The True Story of the Battle of Britian.* New York: Knopf, 1977.

DeMaria, Rusel; and Fontaine, George. *The Official Lucasfilm Games Air Combat Strategies Book.* Rocklin: Prima, 1992.

Federal Aviation Authority. *Pilot Instruction Manual.* Garden City: Hanover House, 1961.

Franks, Norman. *Aircraft versus Aircraft.* New York: Macmillan, 1986.

Gallico, Paul. *The Hurricane Story.* Garden City: Doubleday, 1959.

Girbig, Werner. *Six Months to Oblivion.* West Chester: Schiffer Military History, 1991.

Hynes, Samuel. *Flights of Passage.* Annapolis: Naval Institute Press, 1988.

Jackson, Robert. *Aerial Combat.* London: Cox & Lyman, 1976.

*Jane's Fighting Aircraft of Word War II. N*ew York: Crescent Books, 1992.

Kaplan, Philip. *Little Friends.* New York: Random House, 1991.

Leckie, Robert. *Delivered from Evil.* New York: Harper & Row, 1987.

Mosley, Leonard. *The Battle of Britain.* Alexandria: Time–Life Books, 1977.

Murray, Williamson. *Strategy for Defeat: The Luftwaffe 1933–1945.* Maxwell Air Force Base: Air University Press, 1983.

Price, Alfred. *Fighter Aircraft.* London: Arms and Armour Press, 1989.

Shaw, Robert. *Fighter Combat: Tactics and Maneuvering.* Annapolis: Naval Institute Press, 1985.

Sims, Edward. *The Greatest Aces.* New York: Harper & Row, 1967.

Thomas, Dianne, ed., *Time–Life Books History of the Second World War.* New York: Prentice Hall, 1989.

Toliver, Raymond; and Constable, Trevor. *Fighter Aces of the Luftwaffe.* Fallbrook: Aero Publishers, 1977.

Terkel, Studs. *The Good War.* New York: Ballentine, 1984.

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Index

A

A Visit to St. Denis, 287
Abbeville, 43
Aces of the Pacific, 27
Activity screen, 297
Advancing a tape, 322
Aerial Gunnery mission, 18–21, 200, 211–215, 310
Aerial maneuvers, 200–209
Against the Beachhead, 260
Aim, checking, 177
Aircraft *(see also airplane)*
  appropriations, 110
  asssembly, 111, 112
  design, 113–115
  Detail slider, 308
  identification, 22
  May Be Damaged, 304
  point values, 332, 333
  production, 113
Airplanes
  design, 113–120
  history, 4–13
  in *AOE*, 134–171
    Luftwaffe, 152–171
    RAF, 143–151
    USAAF, 134–143
  production, 109–113, 277, 278
  technological similarities, 27–29
  vulnerability, 134
AI pilots, 330–332
Ailerons, 62, 65
Aim, 177
Air
  combat group, 95
  Medal, 252
  Offensive in Normandy, 351
  power, 11–13
  victories, 247, 248
Airbase menu, 246, 247
Airfields
  in *AOE*, 349, 350
  target point values, 337
Airspeed indicator, 131
Allison engines, 140
Altimeter, 130, 131
Altitude, 59, 60, 117, 118
America OnLine, 317
Ammunition management, 214
Angels, altitude of, 75
Angle of attack, 59
Anti-Shipping mission, 72
Antwerp, 271
Appropriations, 110
Arado 234, 169–171
Ardennes Christmas, 256
Argument, Operation, 91–93
Armor, 133, 134
Arnold, "Hap", 265
Artificial intelligence pilots (*see* AI pilots)
Atlantic Wall, 190, 192
Atmosphere, 59, 60
Attack
  against bombers, 218–221
  against fighters, 217, 218
  head-on, 219, 220
  ordering, 196
  overhead pass, 220, 221
  stern, 220
  the Fighters!, 249
Autopilot, 101

B

B-10Bs, 12
B-17s, 87, 88, 163, 164
  Aerial Gunnery mission, 18–22
  defensive statistics, 164
  Historic mission, 188
  Intercept mission, 106–108
B-24s, 164, 165
B-25s, 165, 166
B-26s, 75, 76, 166, 167
Babington-Smith, Constance, 183
Backup Career, 248
Bailing out, 69, 134, 230
Balloons, 2–4
Bank
  definition, 62
  indicator, 131
Barling bomber, 163
Barrel roll, 66
Battle
  for France, 268, 269
  of Britain, 79–84
  of the Bulge, 278–280
Begin Mission, 249
Berlin, 291, 292
Bf-109s, 38, 39, 152–155, 269
  Close Support mission, 179
  Dogfight an Ace mission, 229
  Dogfight a Squadron mission, 44–47
  Escort mission, 99–103
  Intercept mission, 106–108
  offensive capabilities, 154
Big Blow, 278
Big Week, 91–93, 173, 174
Blackout, 60
Blackouts Allowed, 303
Blind spot, 210, 302
"Blitz", 169
Blitzkrieg, 40–42
BMW 801g-2, 168
Board of Inquiry, 251
Bocage Nightmare, 190–196, 255, 256
Bodenplatte, Operation, 282–285
Boeing B-17 Flying Fortress (*see* B-17}
Boelke, Oswald, 11
Bombardier, 97
Bombers, 12, 13, 162–171, 218–221
Bombing strategies, 93–98
Bombs
  gp, 94
  how to release, 125, 179
Bombsight, Nordon, 93, 97, 98
Bradley, Omar, 270
Brakes, wheel, 70, 71
Braun, Eva, 292
Break turn, 64–66
Bridge target point values, 337
Briefing, 96, 240, 248
Britain, Battle of, 79–84
British Expeditionary Force, 43, 48, 79
Bulge, Battle of the, 278–280
Business option button, 339

C

Calibrate
  command, 306
  joysticks, 355
  throttle sliders, 356
Campbell, Thomas, 173
Camera, 311, 322–324
Cannons, 119
Captures, screen, 326, 327
Career, 243–264
  campaigns, 254–264
    Luftwaffe, 259–261
    RAF, 257, 258
    USAAF, 254–257
  menu, 244
  selecting, 244–246
  tips, 261, 262
Ceiling of the plane, 59
CH FlightStick Pro (*see* FlightStick Pro)
Chandelle, 205, 206
Chase Plane view, 209, 309, 310
Check box options, 19
Checking your six, 209
Chicane, 65
Churchill, Winston, 79, 80, 291
Clear My Tail, 216, 222
Close Support missions, 178–181
Closing in, 210, 211
Coastal battery target points, 338
Cockpit, 125–132
Cockpit view (*see also* Internal view), 322
Combat Level, 301, 305
Compressibility, 60, 61, 67, 140
CompuServe, 317, 343
Conflicts, 355, 356
Congressional Medal of Honor, 252
Consolidated B-24 Liberator (*see* B-24s)
Control options, 355–359
Controls, 126–129, 312
Convergent point, 121
Cooke, Charles, 82
Corsair F4U, 27, 28
COSSAC plan, 173–175
Critical hits, 230
Croix de Guerre, 253
Crossbow mission, 184, 185
Crossbow, Operation, 181, 182
Creating a tape, 324–326
Credits, 297
Curtiss
  P-36C Hawk, 13
  P-40 Warhawk, 141, 142
Customizing *AOE*, 306–309

D

Daimler-Benz engine, 153
Damage points, 214, 215
Data in SQUAD0.DAT, 344–348
Database, world, 307
D-Day, 173–175, 193
Debriefing, 242

DEBUG, 343
Decision over Utrecht, 287
Decline Mission, 248
Decoding system, 186, 267
Defense of France, 188–190, 259, 260
Defense of the Frontiers, 260
Deflection shooting, 27, 46, 123, 212, 213
de Havilland Mosquito (*see* Mosquito)
design, aircraft, 113–115
Detail controls, 308, 309
Difficulty factor, 301, 302
Disengaging autopilot, 101
Distinguished
  Flying Cross, 24, 252, 253
  Service Order, 253
Dive brakes, 128
Do-17s, 38
Dogfight
  an Ace mission, 25–27, 227–229
  a Squadron mission, 44–47, 222
Douhet, Giulio, 11
Dowding, Sir Hugh, 81, 82
Drag, 59
Drop
  firepower, 214
  tank, 179, 304
Droptanks, 118, 133, 179, 304
Drive into Germany, 257
Drive on the Frontier, 256
Dump, hex, 352, 353
Dunkirk, 48, 49, 79
Duty orders, 78
Dynamix, 297, 298, 317

E

Easy combat level, 305
Echelon Left, 222, 225
Echelon Right, 222, 225
Educational aids, 316–318
Eisenhower, Dwight D., 188, 291
elevators, 62, 64, 65, 127
E-mail, 317
Emergency
  procedures, 229–231
  throttle, 170
End of the war, 290–295
Ending a mission, 21, 46, 250
Energy management, 206
Engaging autopilot, 101
Engine Burnout option, 303
Engines, 115–119
  Allison, 140
  BMW 801g-2, 168
  Daimler-Benz, 153
  Griffon, 148, 149
  Junkers Jumo, 156, 159, 160, 169
  Merlin, 117, 142, 143, 148, 150
  Napier Sabre, 144, 146
  Pratt & Whitney, 115, 137, 165, 167
  Wright Cyclone, 166
Enigma coding device, 186
Enter Sim, 71, 108, 324
Escort Bombers mission, 99–103
Evasive tactics, 215–217
Exiting a mission, 69
Expansion boards, 355
Expert Flight Model, 19, 306
External fuel tank (*see* droptank)
External view, 20, 71, 106, 209, 309, 311, 322, 3231

F

F4U Corsair, 27
Fighter
  attacks against, 217, 218
  performance comparisons, 160, 161
  squadrons
    Luftwaffe, 259
    RAF, 258
    USAAF, 255
Finger Four, 45, 82, 222, 223
Firepower, 119–125, 213, 214
Firing
  guns, 120
  rockets, 124, 125
Flaps, 69, 128
Flight
  clicking on, 299
  Control System, 357
  dynamics, 58–64
  inverted, 200, 201
  logs, 313–316
  Map, 44, 100, 275, 300
  Model, 301, 305, 306
FlightStick Pro, 356
Fly a Historic Mission, 187, 274, 276
Fly Next Mission, 248, 249
Flying, basics of, 61–71
Flying Fortress (*see* B-17s)
"Flying Prostitute", 167
Foch, Ferdinand, 109
Fokker, Anthony, 9
Fokker triplane, 10, 11
Folke-Wulfs (*see* FWs)
Form window, 249
Formations, 222–226
Fortified infantry position target point values, 338
Fortitude, Operation, 190
France, battle for, 268, 269
Franco, Francisco, 38
Fuel
  gauge, 132
  tanks (*see also* droptanks), 133
Full Guns, 26, 45, 72, 103, 120, 196, 214, 296, 270
Full screen view, 322
Fury, 12
FW-190s, 20, 23, 27, 39, 135, 155–157, 269
  Aerial Gunnery mission, 18–21
  Crossbow mission, 184, 185
  Dogfight an Ace mission, 25–28, 227–229
  guns, 120, 121
  Historic mission, 188, 190, 195, 196
  Intercept mission, 75, 76
  offensive capabilities, 157
  Scramble mission, 269, 270
  St. Trond Waltz, 287, 288

G

Galland, Adolf, 33, 39, 104, 158, 266, 272–274, 278, 282, 288–290
Game Publishers C forum, 317
Garden, Operation, (*see* Operation Market-Garden)
Garros, Roland, 8
General-purpose bombs (*see* gp bombs)
GEnie, 317
Georges, 27
German Cross in Gold, 253
G-force, 26, 60
Girding for the Storm, 260
Glen L. Martin Company, 12
Goering, Hermann, 31, 34–36, 41, 79–83, 85, 86, 104, 105, 267, 272, 278, 282, 288
Going under the hood, 129
Gp bombs, 94
Gr:21 rockets, 124, 188, 189
Great War Planes, 28
Griffon engine, 148, 149
Ground
  Attack mission, 73, 74
  Detail slider, 398, 309
  target point values, 336–341
Group-floor, 11
Group tactics, 221–227
Gun Jams Allowed, 302
Gunnery skills (*see also* Aerial Gunnery mission), 211–215
Guns, 8, 9, 119–123
Gunsights, 122, 123
Gyroscopic sight, 123

H

Hammerhead (*see* wingover)
Harmonization point, 121
Harbor facility target points, 338
Hard combat level, 305
Hatfield, Tucker, 331
Hawk, 13
Hawker Fury, 12
Hawker Tempest, 121, 145–147
Hawker Typhoon, 143–145
He 111, 38, 83
Head-on attack, 219, 220
Heinkel He 111 (*see* He 111)
Hess, Rudolf, 36
Hex dump, 352, 353
High yo-yo, 207, 208
Himmler, Heinrich, 272
Historic missions, 187–196, 287, 288
Historical simulations, 317
Hitchcock, Thomas, 142
Hitler, Adolf, 36–38, 40, 41, 77, 79–83, 85, 86, 103–105, 190, 192, 267, 268, 272, 278, 282, 291, 292
Hitler Youth, 77
Hits, critical, 230
Hurricanes, 82

I

Identification of aircraft, 22
IFF, 326, 327
Immelmann maneuver, 66, 67, 216
  Arado 234, 171
  Bf-109, 154
  FW-190, 156, 157
  Me-262, 160
  Mosquito, 151
  P-38, 140
  P-47, 138
  P-51, 142
  Tempest, 146
  Typhoon, 145
  Spitfire, 149
Immelmann, Max, 66
Independent view, 323, 324
In-line engines, 115, 116
Inskip, Sir Thomas, 13
Instrument panel, 129–132
Intercept mission, 74, 75, 84, 85, 163
Interchange File Format (*see* IFF)
Interdiction Missions, 175–178
Intermediate Flight Model setting, 305
Internal view (*see also* Cockpit view), 21, 209, 309
International Military Tribunal, 37
Inverted flight, 200, 201
IP point, 97
Iron Cross, 253

J

Jagdverband 44 (*see* JV-44)
Jams, gun, 120, 302
Japanese planes, 27, 28
Jettison tanks, 118
Johnson, Robert, 22–25
Journals
  Gerhardt Lichter, 39, 40, 105, 106, 224–226, 285, 286
  Lloyd "Buster" Stinson, 17, 18, 30, 31, 71, 72, 179, 180, 262, 280–282
Joysticks, 127, 311, 312, 355–357
Ju 88 (*see* Junkers Ju 88)
Junkers Ju 88, 83–85, 168
Junkers Jumo
  213A-1, 156
  turbojet, 159, 160, 169
JV-44, 288–290

K

Keiter, Wilhelm, 293
Kepner, William, 90
Kette, 223, 224, 226
Knife-edge, 26, 201, 202
Knight's Cross, 253, 289
Kommando Nowatny, 274–276
Krauss, Robert, 35

L

Laminar flow wing, 142
Landing, 69–71, 128
Lawrence, T. E., 199
Legion of Merit, 252
Leningrad, 181
Liberator, (*see* B-24s)
Library 7, 317
Lift, 58
Lightning (*see* P-38s)
Lightning War (*see* Blitzkrieg)
Limited
  Ammunition, 303
  Fuel, 19, 303, 304
Line Abreast, 222, 224
  Astern, 222, 224
Load, 320
Location
  counter, 322
  slider, 321
Lockheed P-38J Lightning (*see* P-38s)
London, 85, 86
Look Up view, 46
Loop, 67, 68
Losing contact, 224
Low yo-yo, 208, 209
Loyalists, 38
Luftwaffe
  after D-Day, 266–269
  aircraft assembly, 113
  airplanes, 152–171
  bombs London, 85–89
  campaigns, 259z
  countering Allied attacks, 103–105
  fighter squadrons, 259
  flying for in *AOE*
  history of 33–49
  pilots, 37, 77, 78, 234–236, 238, 239
  medals, 253, 254
  preparations for D-Day, 185, 186
  resurgence, 276–278
  retirement, 263
Luther, Margin, 1

M

Machine guns, 119
Maginot Line, 38
Map
  bringing up, 229
  Flight, 44, 100, 275, 300
  weather, 93
Maintenance crews, 242
Maneuvers, aerial, 200–209
Marauder (*see* B-26s)
Market–Garden, Operation, 270, 271
Marine F4U Corsair, 27
Martin B-26 Marauder (*see* B-26s)
Me-109s, 23, 32, 82, 83, 126
Me-262s, 121, 128, 130, 157–160, 217, 230, 269–276, 289, 290
Medals, 252–254
Menus, 297–300
Merlin engine, 117, 142, 143, 148, 150
Messages, 250, 251
Messerschmitt, 23, 38, 152–155
  109s (*see* Me-109s)
  Bf-109s (*see* Bf-109s)
Midair Collisions, 304
Milch, Erhard, 79
Mission
  briefing, 99, 100
  Briefing screen, 298, 300–306
  log sample, 315
  Recorder, 71, 76, 185, 189, 309, 317, 319–327
  Selection screen, 99, 187
  Setup screen, 298–300
Missions
  Aerial Gunnery, 18–21
  Anti-Shipping, 72
  Bocage Nightmare, 190–196
  Close Support, 178–181
  Crossbow, 184, 185
  Defense of France, 188–190
  Dogfight
    a Squadron, 44–47
    an Ace, 25–27, 227–229
  Escort, 99–103
  Ground Attack, 73, 74
  Historic, 187–196, 274–276, 287, 288
  Intercept, 74, 75, 84, 85, 106–108, 163
  Interdiction, 175–178
  Landing, 64–71
  Opening Day at Achmer, 274–276
  Scramble, 269, 270
  St. Trond Waltz, 287, 288
  The Bell Tolls at Leuna, 188–190
  Training, 18–21, 64–77, 84, 85, 324
  Tree Clippers Inc., 193–196
Missions Flown, 247
Mitchell (*see* B-25s)
Mitchell, Billy, 11, 12
Models, 318
Monogram Models, 318
Montgomery, General, 270, 271
Morgan, Sir Frederick E., 173
Morse code, 54
Mosquito, 149–151
  design, 114, 115
  instrument panel, 130
  offensive capabilities, 151
Moving through a tape, 321, 322
Multifunction card, 357
Mustang (*see also* P-51s),25–28, 90, 91, 227–229

N

Napier Sabre engine, 144, 146
Nates, 27
Navigation, 101
No Inflight Info, 304, 305
Nordon bombsight, 93, 97, 98
Normal resolution, 309

North American
B-25 Mitchell (*see* B-25s)
P-51D Mustang (*see* P-51s)
Novice Flight Model, 305
Nowotny, Walter, 273, 274
Nuremberg, 37

O

Odessa, 181
Oil pressure, 132
On-line vendors, 317
Opening Day at Achmer, 274–276
Operation
Argument, 91–93, 173, 174
Bodenplatte, 282–285
Crossbow, 181, 182
Fortitude, 190
Market–Garden, 270, 271
Overlord (*see also* D-Day), 108, 173, 175
Pointblank, 173, 174
Operations, 94, 95
Ordering an attack, 196
Orders, duty, 78
Other Options menu, 297, 301, 306
Overhead pass, 1097, 220, 221
Overlord, Operation (*see also* D-Day), 108, 173, 175
Oxygen tanks, 127

P

P-36C Hawk, 13
P-38s, 61, 89, 90, 96, 128, 130, 139–141, 178–181
P-40 Warhawk, 141, 142
P-47s, 21–25, 89, 90, 96, 126, 136–139, 193, 194
Anti-Shipping mission, 72
Escort mission, 99–103
Historic mission, 194–196
Interdiction mission 176–178
St. Trond Waltz, 287, 288
P-51s, 32, 90, 91, 96, 104, 119, 141–143
Dogfight an Ace mission, 25–28
Historic mission, 274–276
Training mission, 18–21
Patch, 317
Patton, General, 270, 271
Pearl Harbor, 86
Peenemunde, 183
Performance comparisons of fighters, 160, 161
Pilot
AI, 330–332
characteristics, 31
fighter, 233–243
log sample, 314
names, 244
Record, 247, 248
skill levels, 299, 300
training, 51–58
Pitch, 62, 63
Plane descriptors, 300
Planes (*see* airplanes)
Play, 321, 322
Point values, 214, 215, 332–340
Pointblank, Operation, 173, 174
Ports, joystick, 355
Pratt & Whitney engine, 115, 137, 165, 167
Preddy, George E., Jr., 227–229
Preferences panel, 306, 308, 309, 356
Preferences screen, 357, 359
Preflight Options, 44, 100, 118, 249, 300, 301
Priller, Josef "Pips", 25–28
Prodigy, 317
Promotions, 251, 252
Propeller, 59, 116, 117, 127
Pull Back on the Stick, 101
Purple Heart, 252
PZL P-11, 12

R

R4M rockets, 124, 289
Radar Direction Finding (*see* RDF)
Radial engines, 116
Radio, 195, 221, 222, 250
Radio Shack, 313
RAF
airplanes, 143–151
campaigns, 257, 258
communication systems, 94
fighter squadrons, 258
France, 47–49
medals, 253
pilots, 233, 234, 238, 239
retirement, 263
Range
expanding, 118, 119
firepower, 213, 214
RDF, 81, 82
Realism
panel, 19, 20, 101, 210, 301–306
settings, 19, 65
Realistic Weather, 302
Recon photo, 336
Record
locating, 351
Structure, 345–349
Recovering from a stall or spin, 68, 69
Red Baron (*see also* Von Richtofen, Manfred), 36, 51, 52
Red Baron, 28
red-out, 60
Reflector sights, 122
Releasing bombs, 125, 179
Removing the control panel, 322
Replay Mission, 46, 185
Republic P-47D Thunderbolt (*see* P-47s)
Resolution, 309
Restore, 301
Retirement, 263
Rewind button, 321
Rockets, 124, 125, 181–185, 289
Rolls, 66
Rolls-Royce
Griffon engine (*see* Griffon engine)
Merlin engine (*see* Merlin engine)
Rommel, 190
Roosevelt, 291

Rotte, 223, 224, 226
Rouen, 194, 195
Royal Air Force, (*see* RAF)
Rudder
  definition, 63, 64
  gauge, 132
  movement, 65
  pedals, 126, 359

S

Sample
  mission log, 315
  pilot log, 314
Save, 27, 76, 311
Save Mision To Tape, 71, 391
Schuck, Walter, 39
Schwarm, 44, 45, 223, 226
Scissors, 65
Scoring in *AOE*
Scramble mission, 269, 270
Screen captures, 326, 327
Sea Lion, Operation, 80–84, 86
Setting up a mission, 43
Shakespeare, William, 15, 233
Sherman, William Tecumseh, 297
Ship point values, 335, 336
Shooting, deflection, 27, 46, 123, 212, 213
Siegfried Line, 271
Silver Star, 252
Skid, 202, 203, 216
Slye, Damon, 28
Sound cards, 312, 313, 356
Spanish Civil War, 13, 38, 42
Sperrle, Field Marshal, 186
Spin, 68, 69
Spitfires, 13, 147–149
  Battle of Britain, 82–84
  Crossbow mission, 184, 185
  Dogfight a Squadron mission, 44–47
  Intercept mission, 84, 85
Split-X, 67, 203, 204, 216
SQUAD0.DAT file, 343, 353
Squadron
  address in SQUAD0.DAT file, 351
  bar, 136
  Info, 246, 247, 298
  of Experts, (*see* JV-44)
  Selection screen, 245, 246, 298
Squadrons (*see* fighter squadrons)
Stalin, 291
Stall
  definition, 59
  landing, 69–71
  recovery, 68
  speed, 61
  turn (*see* wingover)
  warning light, 132
Standard Combat Level, 19, 305
Start
  Career, 244, 245
  tape, 324
Stats button, 136
Stern Attack, 220
St. Lo Surprise, 256
Stop button, 321
Struggle over France, 255
Stuka dive-bombers, 13, 40, 43, 48
Successful Missions, 247
Sun Blind Spot, 210, 302
Superchargers, 117, 118
Supermarine Spitfire (*see* Spitfires)
Supply depot target points, 340
Switch button, 323

T

Tachometer, 131, 132
Taking off, 61
Tall resolution, 309
Tapes
  advancing, 322
  creating, 324–326
  playing back, 322
TAPES directory, 319
Temperature, engine, 46, 65, 132
Tempest, 145–147
The Bell Tolls at Leuna, 188–190
The Hard Road, 258
The Last Hurrah!, 261, 287, 288, 290
The Normandy Beachhead, 257
Throttle
  control products, 356–358
  effect on pitch, 62, 63
  emergency, 170
  how to operate, 128
ThrustMaster controls, 357–359
Thunderbolt (see P-47s)
Time Scale, 307, 308
Tracers, 122
Training
  missions, 18–21, 64–77, 84, 85, 324
  pilot, 52–58
Treaty of Versailles, 33, 41
Tree Clippers Inc., mission, 193–196
Turns, 64–68, 204, 205
Typhoon, 73, 143–145

U

Ultra decoding system, 86, 267
Unit record structure, 345–349
United States Army Air Force (*see* USAAF)
Up view, 26
USAAF
  airplanes, 134–143
  campaigns, 254–257
  fighter squadrons, 255
  medals, 251, 252
  pilots, 53–58, 235, 236, 238, 239, 276
  retirement, 263
Utah Beach, 191

V

V rockets, 181–185
V-1 (*see* V rockets)
V-1 site target points, 340
V-2 (*see* V rockets)
Vee formation, 22, 223, 224
Vehicle
  data base, 135, 136
  point values, 333–335
Versailles, Treaty of, 33, 41
Verticle Speed Indicator (*see* VSI)
VFW, 316
Victoria Cross, 253
Victory Assured, 258
Video aids, 316, 317
Vienna, 291
View
  Best Careers, 244
  controls, 309–312
  Pilot Record, 247
  saving, 331
  the War Map, 247
  using, 209, 210
  Vehicles, 318
  Which menu, 135
Visibility, cockpit, 126
Von Richtofen
  Manfred, 36, 51, 52
  Wolfram, 42
VSI, 131, 205
Vulnerability of planes, 134

W

War
  begins, 13, 14
  ends, 290–295
  Map, 247
Warfare, 2–7
Warhawk, 1 41, 142
Warning lights, 46, 132
Warsaw, 40
Weapon view, 310, 311
Weapons Control System
  Mark I, 357, 358
  Mark II, 358, 359
Weather, 93
Wehrmacht, 13
Wheel brakes, 70, 71, 128
Whirlwind tanks, 195
"Widow Maker", 167
Window, 190, 191
Wingman, flying as, 249, 250
Wingover, 204, 205
World
  database, 307
  Detail slider, 308
Wright
  brothers, 4–6
  Cyclone engine, 166

Y

Y radio-interception service, 269
Haw, 63, 64
yo-yo maneuvers, 206–209
  hi, 207, 208
  low, 208, 209

Z

Zemke, Hub, 193–196
Zeros, 27, 28, 133
Zoom, 202, 222, 309

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ISBN 1-55958-520-X

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An Imprint of Prima Publishing